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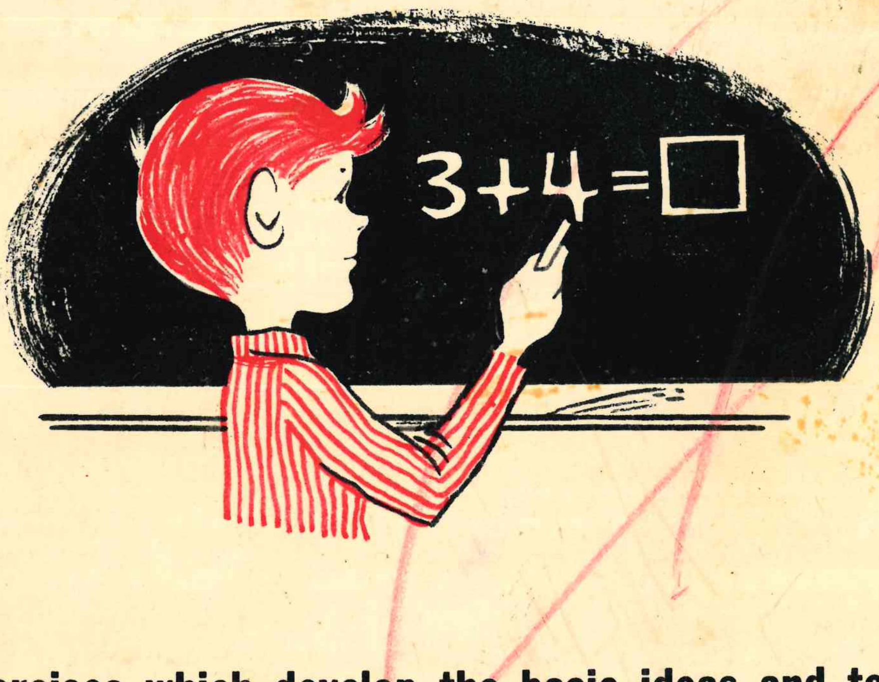
CHILD · PARENT WORKBOOK

59¢

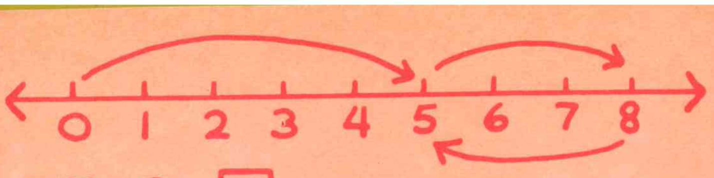
NEW MATHEMATICS

Sets and Addition

PRACTICE WORKBOOK

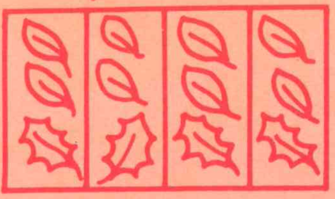


Exercises which develop the basic ideas and terms used in New Mathematics programs, with easy-to-understand explanatory notes for parents and teachers.



5+3=□
□−3=5

set partition



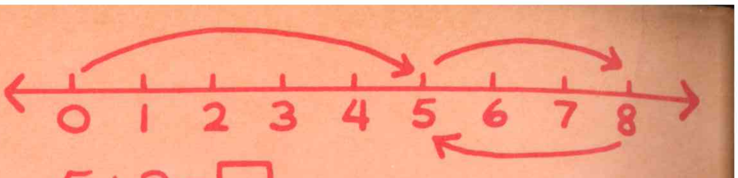
X ÷

+	0	1	2
0	0	1	2
1	1	2	3
2	2	3	4

2 X 5 = 10
5 X 2 = 10

expanded notation

41 = △ tens + □
+55 +▽ tens + ▽
◇ tens + ○ = ⬠



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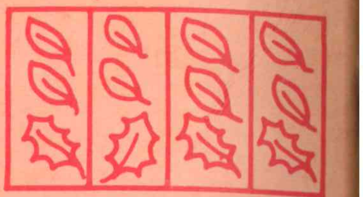

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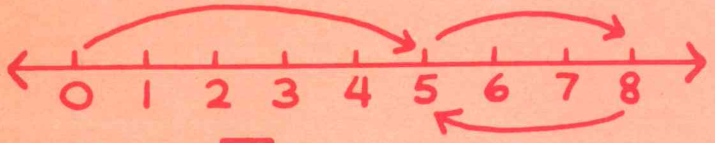

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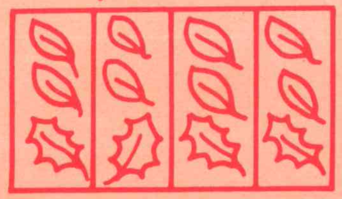

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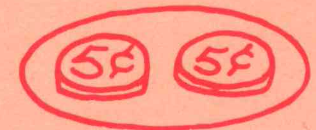

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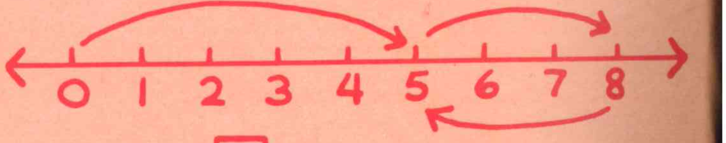

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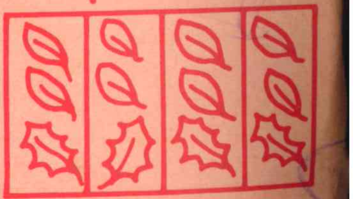

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NEW MATHEMATICS
Sets and Addition

PRACTICE WORKBOOK

By MARCIA LEVIN and JEANNE BENDICK
Illustrated by JEANNE BENDICK

Authors of "Take a Number,"
"Take Shapes, Lines and Letters"
and "Mathematics Illustrated Dictionary."

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Note to Parents and Teachers

You *can* help your children with the new mathematics. You will find in this book an easy step-by-step development of the concepts and terminology of the new mathematics.

Before beginning, you will want to know what the new mathematics is, and why it is being introduced throughout the nation.

Teachers and educators today do not assume that most children will become professional mathematicians. What they do stress is that children will learn the underlying structure and pattern of all mathematics; that they will be able to move with ease from one area of mathematics to another; that they will be able to understand what they are doing and why, instead of memorizing isolated facts and tables; and, perhaps most important, that they will find mathematics an exciting and rewarding subject. True, they still learn the fundamentals — how to add, subtract, multiply and divide. But their learning is now geared to the "knowledge explosion" of our times.

Words in this book, like *set, placeholder, inequality,* may seem strange at first, but as the practice exercises are developed it will be seen that the precision of language and the careful building of one idea on another, make the "new" mathematics much clearer and more easily understood than the old.

It is important that the procedures given here be followed exactly. The notes on the bottom of each page serve as guides for additional practice, and help the adult amplify the work where necessary.

The Practice Workbook for the New Mathematics, Book II, will review briefly all the material appearing in Book I, and then will go on to sets and subtraction, vertical notation, zero, place value, some of the properties of arithmetic, and reading and writing numerals to 99.

Working in this book will probably be as stimulating an experience for the adult who guides the child as for the child himself, and the "new" mathematics will reveal new horizons for adult and child alike.

The authors wish to thank W. Ervin Marriot, an editor of mathematics textbooks for the elementary schools, for his review of this book.

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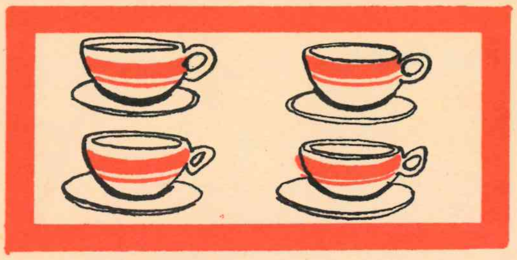
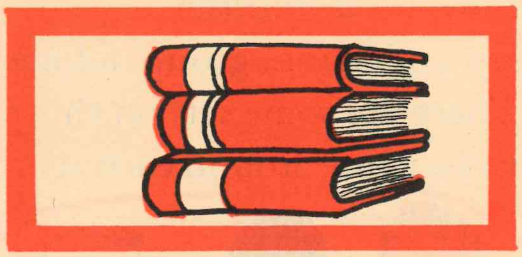
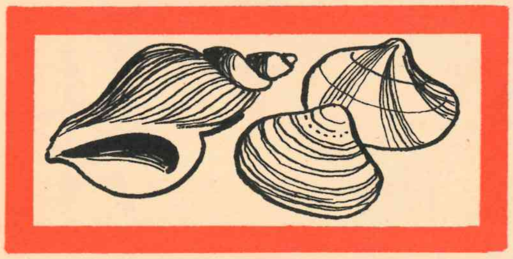
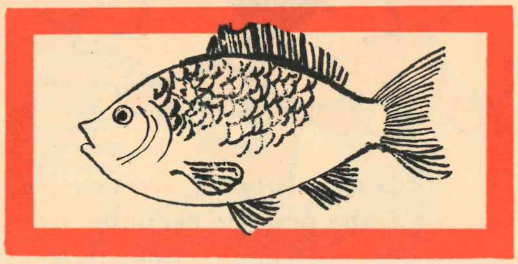
SETS

What is a set?
These are all sets.

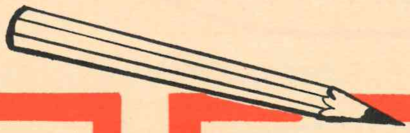








Can you think of other sets of things?
Draw them here.

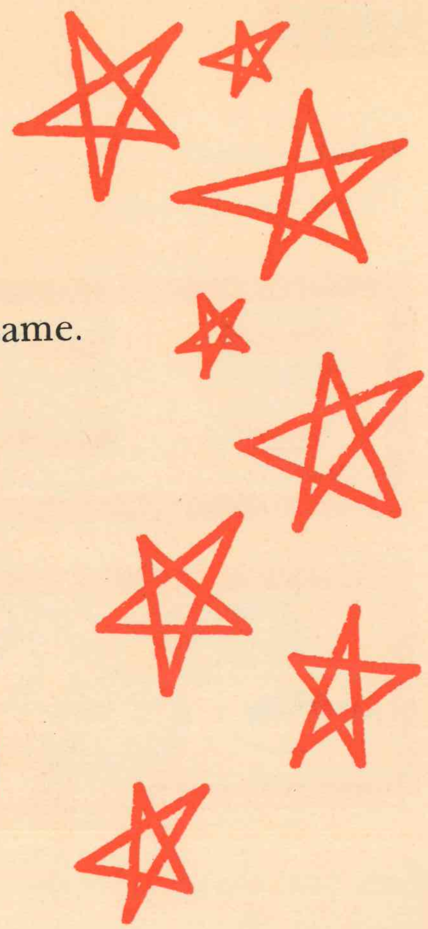


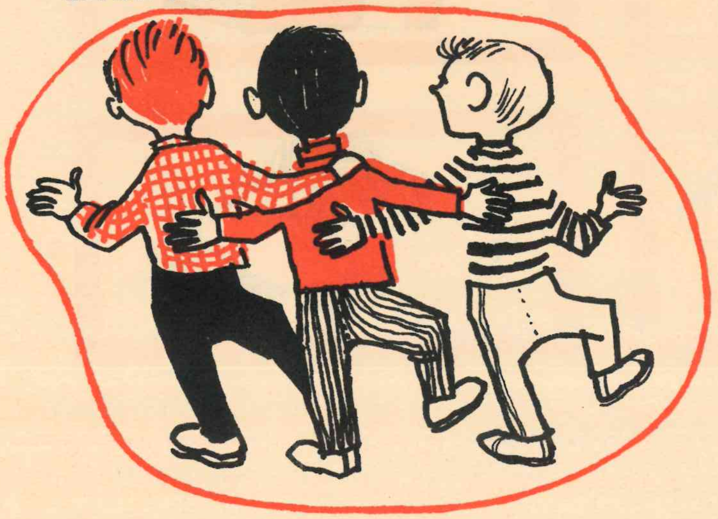
You could have drawn a set of trains, a set of dolls, or many other sets.

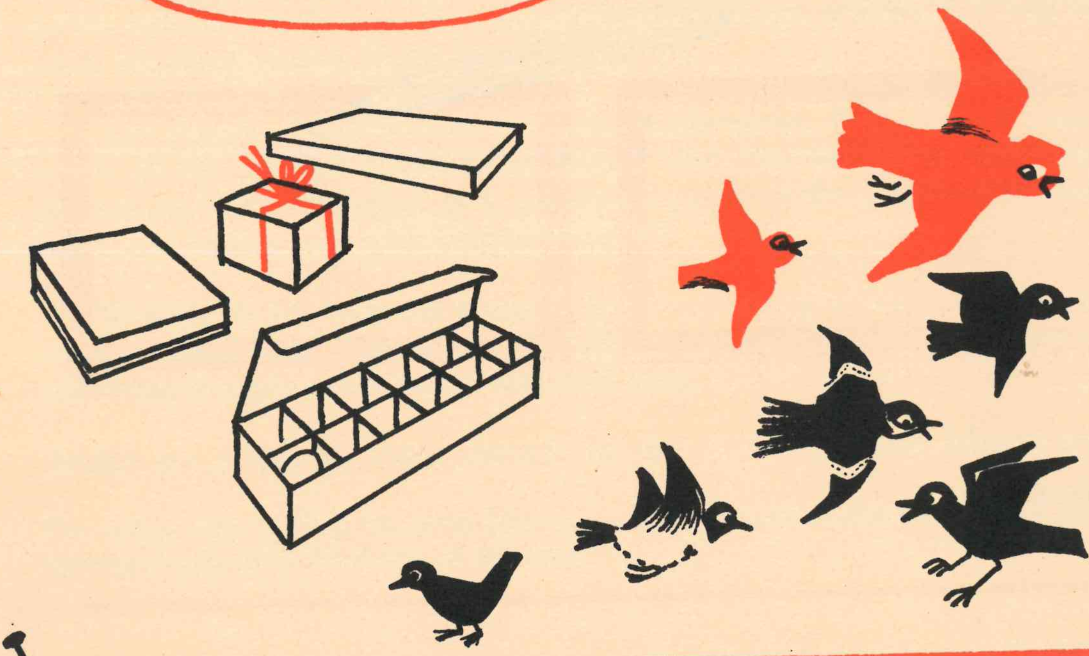
NOTE: The idea that certain elements belong together is part of "set theory." It is one of the most important concepts of modern mathematics. Children are usually aware of the idea of sets. This page helps to clarify it.

SETS

Sometimes a set is called
a *group* or
a *collection*.
Set, collection, group, all mean the same.
There are some sets on this page.
Draw a line around each set.







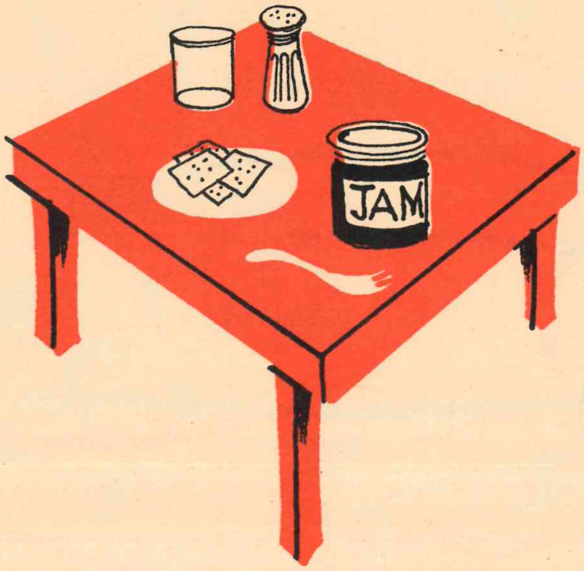
NOTE: The child should be able to encircle each of the 4 separate groups: boys, stars, boxes, and birds. He should notice that each group or set has certain properties in common.

SETS

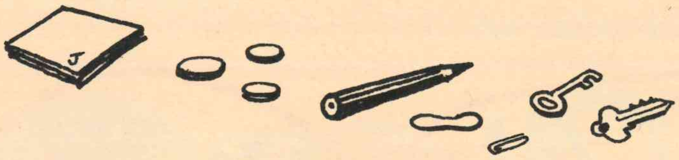
Does everything in a set have to be the same?

Here is a set of things on a table.

Is everything on the table the same? Yes ____ No ____



Here is the set of things in John's pocket.



Is everything in John's pocket the same? Yes ____ No ____

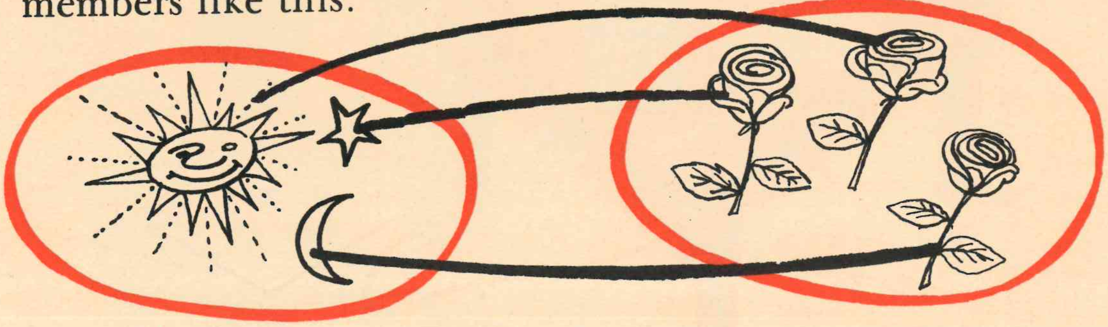
Draw the set of things on your desk.

NOTE: Although many groups of things are thought of as sets because their members are similar (such as a set of crayons), other sets belong together because of their location or some other common property.

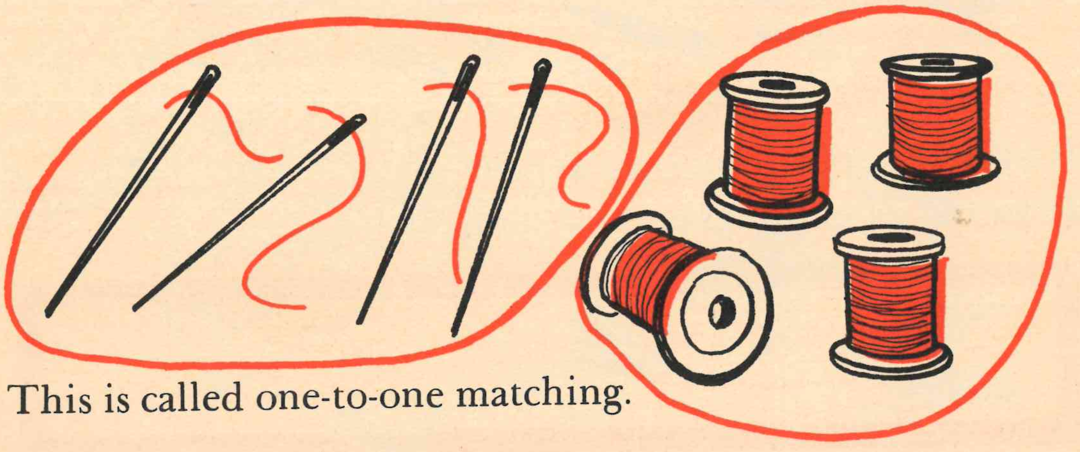
ONE-TO-ONE MATCHING

The *things* that make up a set are also called
the *members* of the set or
the *elements* of the set or
the *objects* of the set.

You can find out whether two sets have the same number of members like this.



Draw a line between each member of one set and each member of the other set. See if each member of one set can be matched with a member of the other set.

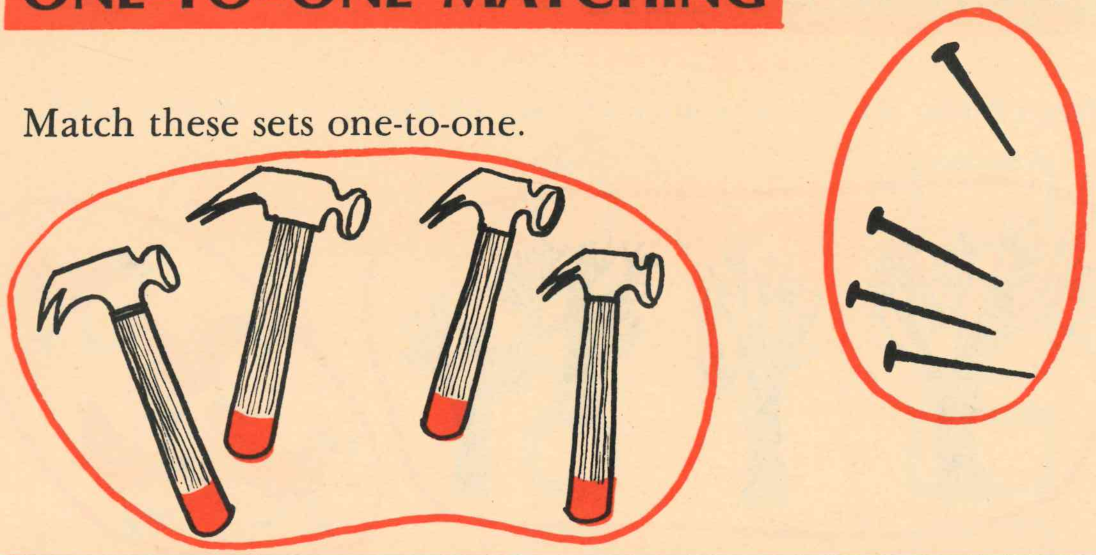


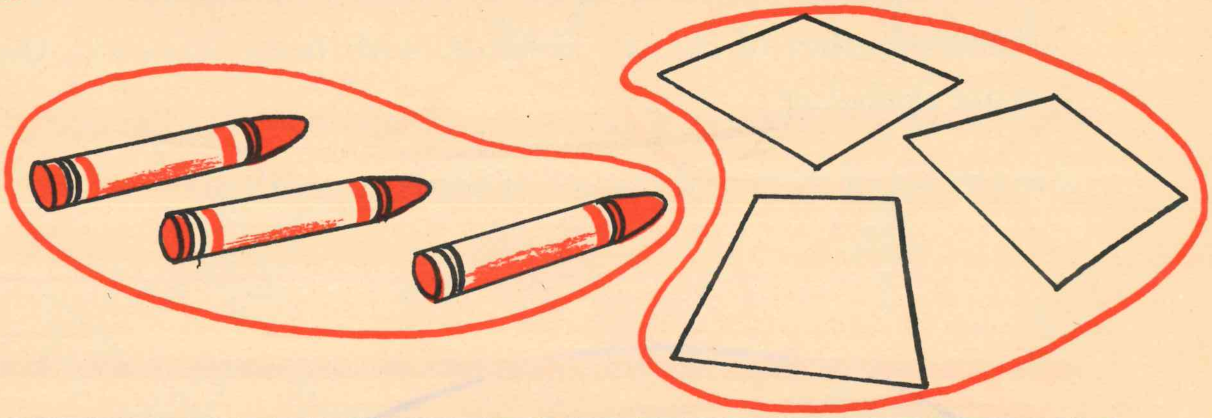
This is called one-to-one matching.

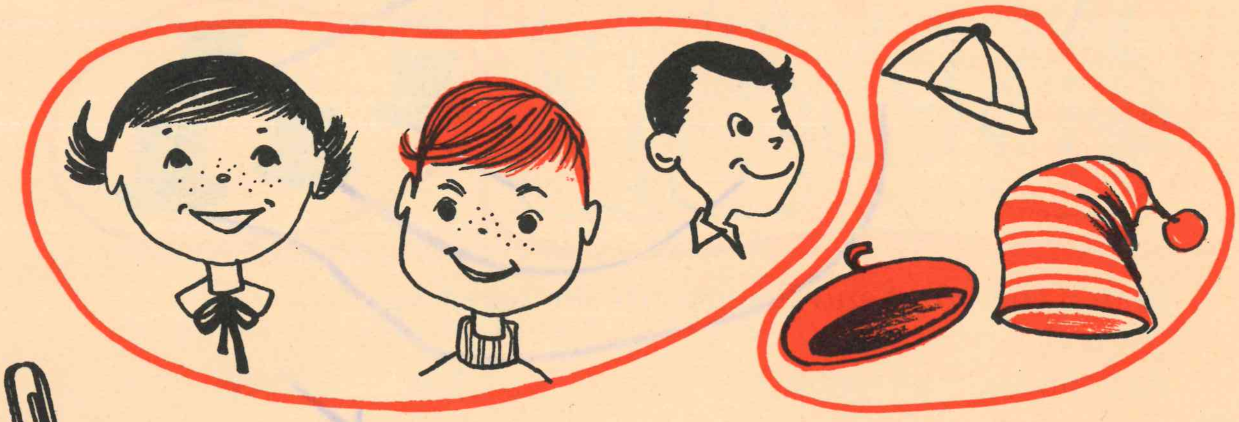
NOTE: One-to-one matching, or one-to-one correspondence, is another important concept. It was the forerunner of counting, because sets could be matched (as a shepherd tallying sheep with pebbles) without numbers being used.

ONE-TO-ONE MATCHING

Match these sets one-to-one.





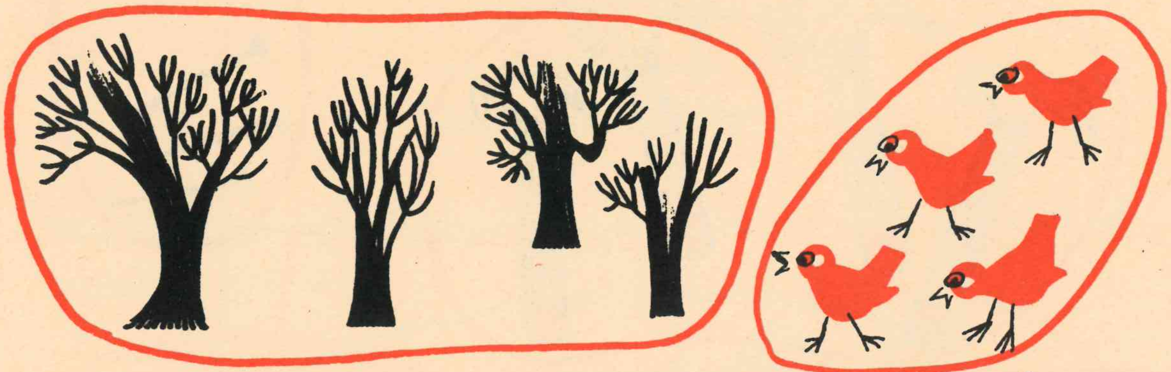


NOTE: Although at first it is necessary for the child to draw lines to show one-to-one matching, eventually he will be able to see at a glance that if the number of objects in each set is the same, there will be a matching.

At this stage, however, the members of the sets should be matched, not counted.

EQUIVALENT SETS

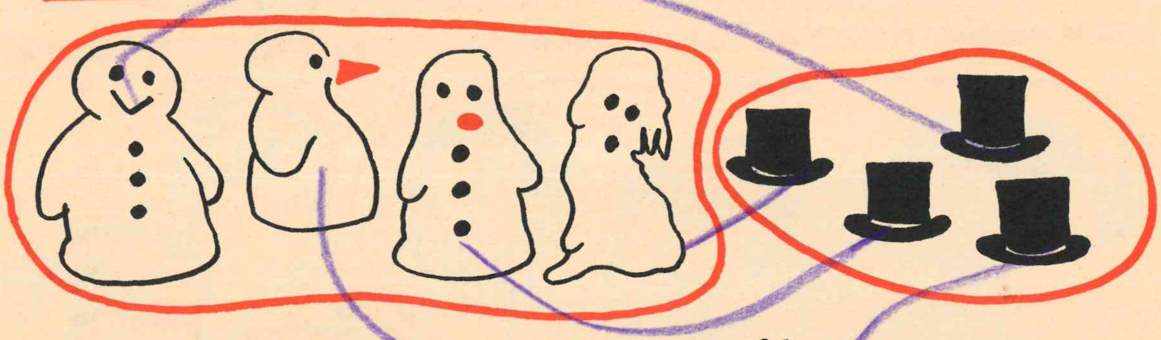
Match the set of trees with the set of birds.



If a line can be drawn from each member of the set of trees to each member of the set of birds, with none left over, the sets are *equivalent*.

Are the set of trees and the set of birds equivalent?

Yes ____ No ____



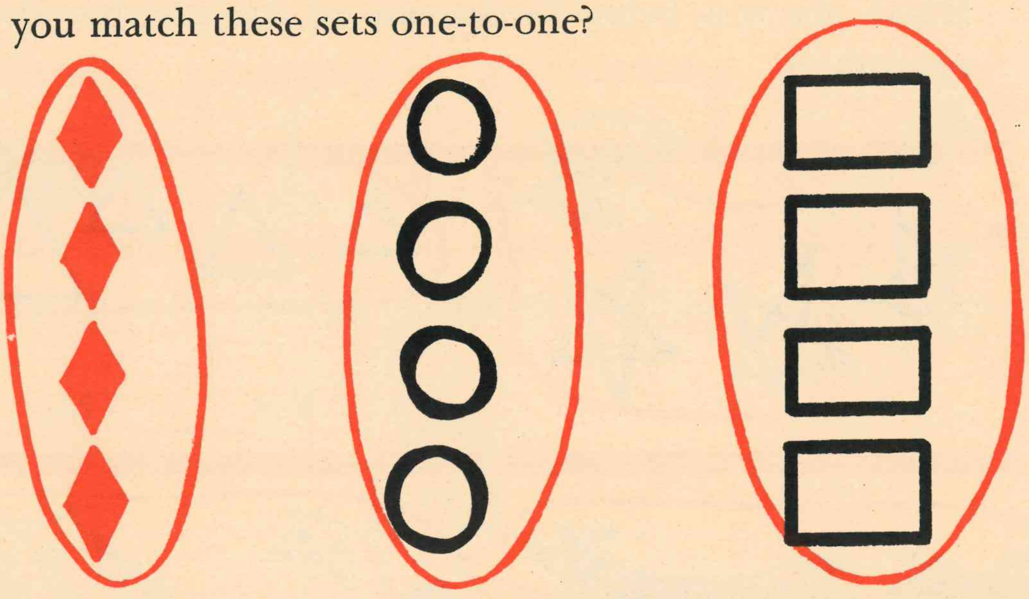
Match the set of snowmen with the set of hats.

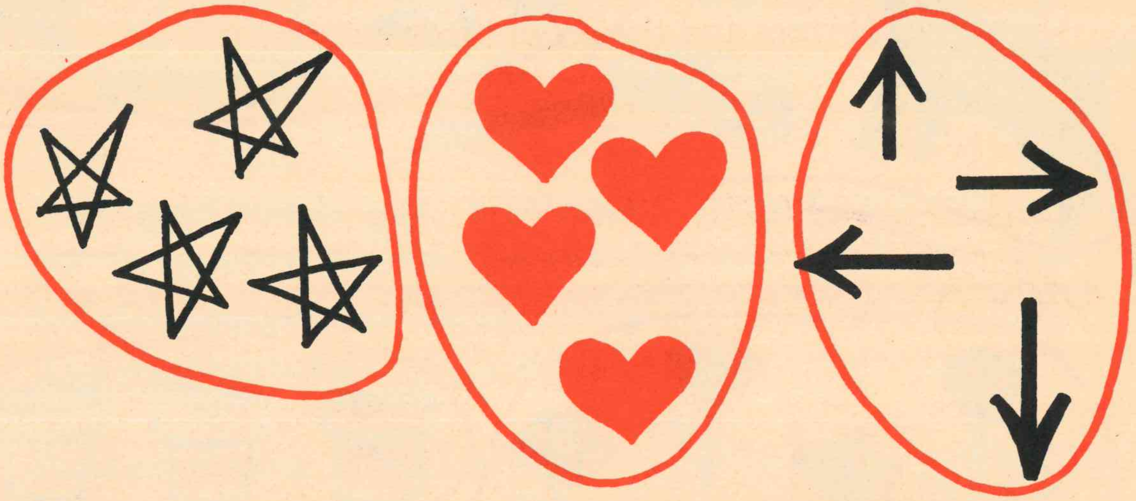
Are the sets equivalent? [✓ Yes] ____ No ____

NOTE: The sets on this page are equivalent, because they can be matched one-to-one. In the new mathematics, the word *equals* and the *equals* sign(=)are never used in describing the equivalence relation between sets.

EQUIVALENT SETS

Can you match these sets one-to-one?





Sets which contain the same number of elements are called *equivalent* sets.

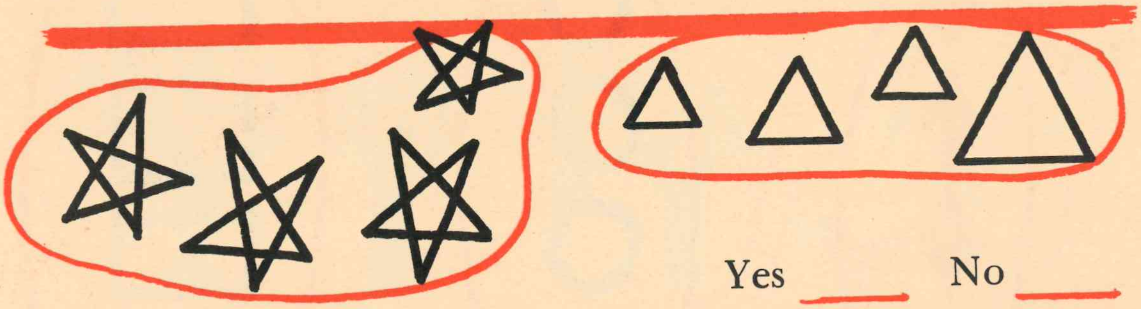
NOTE: The set of diamond shapes can be matched one-to-one with the circles, and the circles can be matched one-to-one with the rectangles.

All sets which contain the same number of members are called equivalent sets.

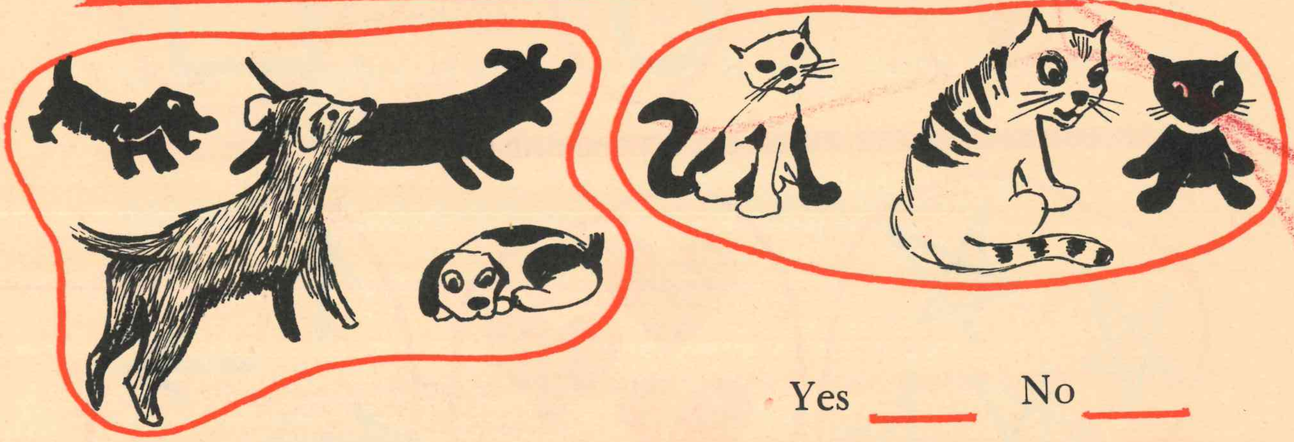
The word *equivalent* means "having the same value."

NON-EQUIVALENT SETS

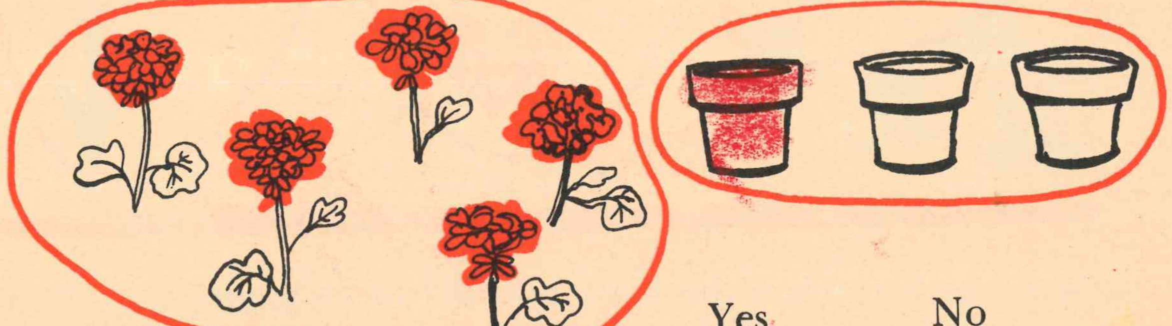
Match the sets below one-to-one to see whether they are equivalent.



Yes ____ No ____



Yes ____ No ____



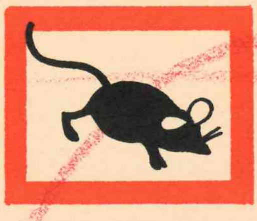
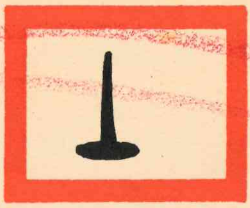
Yes ____ No ____

NOTE: The set of stars and the set of triangles are equivalent because there is a one-to-one matching. The set of dogs has 1 more than the set of cats, so they are not equivalent. The set of flowers has 2 more than the set of flowerpots, so they are not equivalent.

The children can gain practice in understanding the equivalence relation by activities such as setting the table. (Is there a fork for each plate, a napkin for each person?)

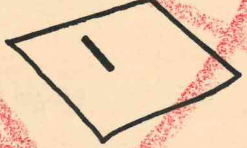
ONE

How many members are in each set?

You can show the number in each *set* by holding up one finger.

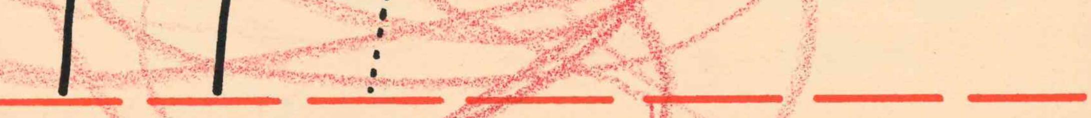
You can make one mark on a piece of paper.



You can put aside one stick.

The word which tells "how many" in each of these sets is *one*. In other countries, people may use a different word for that number, but we call it *one*.
The symbol that stands for *one* is 1.

Practice writing 1. Start at the top, and make a straight line down.



NOTE: Even if a set contains only 1 object, it is called *a set of one*. The word *one*, or the numeral 1, stands for that many objects.

In French, the name is *un;* in German, it is *ein*.

But they all stand for the same number.

NUMBERS AND NUMERALS

The symbol that stands for a number is called a *numeral*.

You can write a numeral, like the numeral 1.

The numeral 1 represents the number idea *one*.

This is called a *cloud*.

You can write the word *cloud*, but you can not write the cloud itself.

You can write the name for this.

But you cannot write the candy itself.

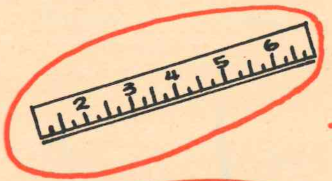
Write your own name here.

You wrote your name, but you cannot write yourself on this page.

You use a numeral to represent a number idea.

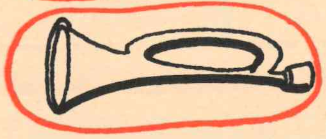
The numeral tells the number of things you are thinking about.

What is the numeral for this set?



_____

What is the numeral for this set?



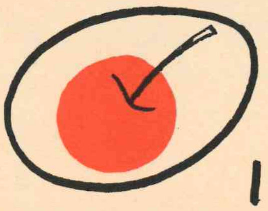
_____

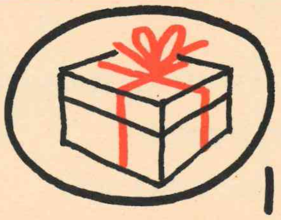
NOTE: A numeral is a symbol representing a number of things. The word *numeral* is used when referring to the written symbol. Otherwise, the word *number* is used.

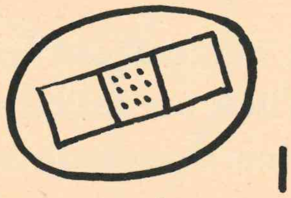
SETS OF ONE

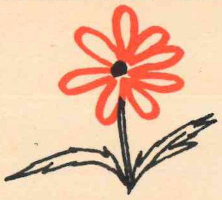
Draw a line around the sets in each row that have one member.

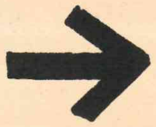
Mark the set with the numeral 1.
The first row will show you how.

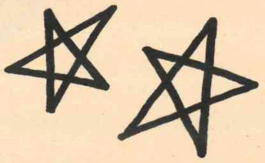


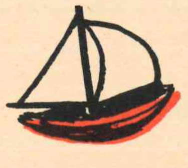


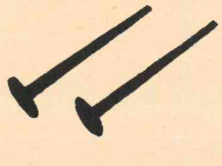


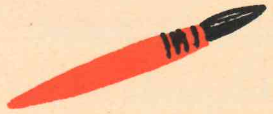


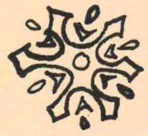


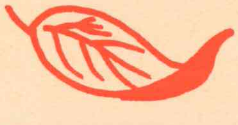


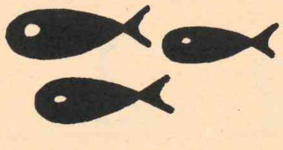










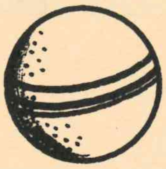


NOTE: The child should encircle each set of one, and write the numeral below it. The set of 2 stars in the second line, of 2 nails in the third line, and 3 fish in the fourth line, should not be encircled.

Discuss other sets of one — 1 nose, 1 mouth, 1 baby, 1 sun, 1 moon.

TWO

Color this ball red.



We now have a set of one red ball.
Write the numeral for the set here. ____

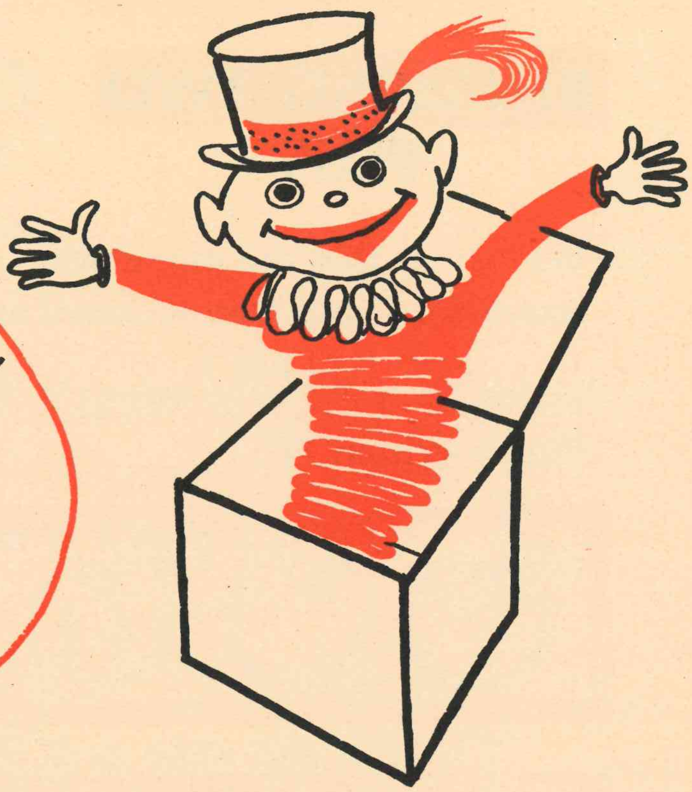
A numeral can be written in shapes like □, △, or ⯃.
These are called *number frames*.
How many balls are in the next set?

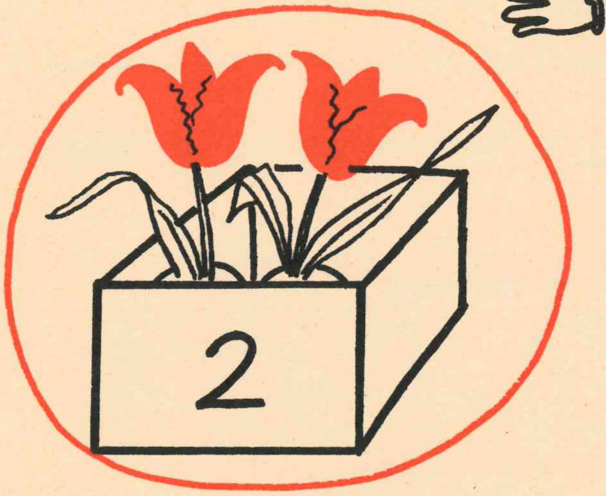
Write the numeral. ____
Color the ball blue.
Now draw another blue ball, next to the one blue ball.
The set of blue balls has the same number as the set of red balls, *and 1 more*.
The name of the number for the blue set is *two*.
The numeral is written 2.
Practice writing 2.

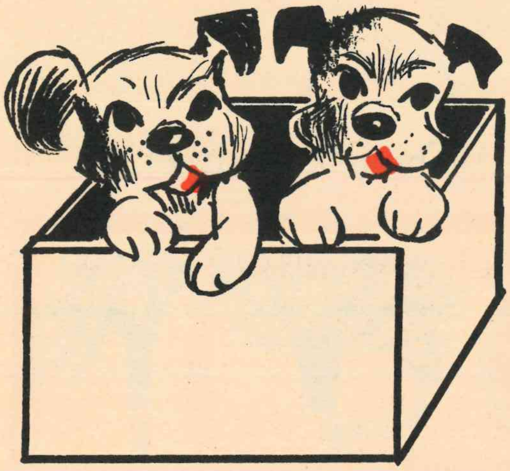
2 2 2 ____ ____ ____ ____

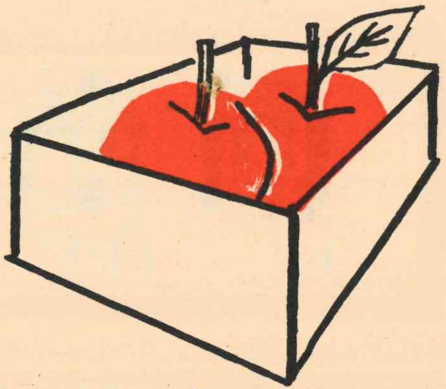
NOTE: The set of blue balls is not equivalent to the set of red balls. The concept of "one and one more" is the beginning of the idea of the "one more" pattern used in the set of all counting numbers. This idea will be developed.

SETS OF TWO









Draw a line around each box that has a set of two members in it.

Write the numeral 2 on the boxes that have two members.

NOTE: Remind the child that the numeral 2 stands for a certain number of objects. The concept of 2 can be further developed by having him name other sets of two: 2 eyes, 2 ears, 2 arms, 2 legs, 2 hands, etc.

RENAMING TWO

PLUS

We can say that the numeral 2
stands for 1 and 1 more or
1 *plus* 1.

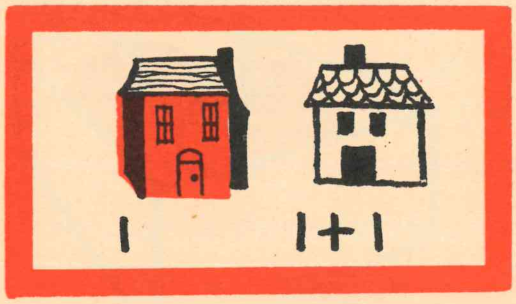
Plus is written **+**.

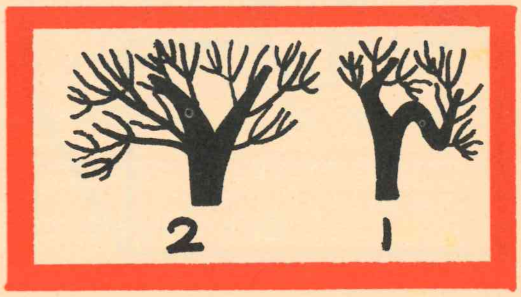
1 plus 1 is written

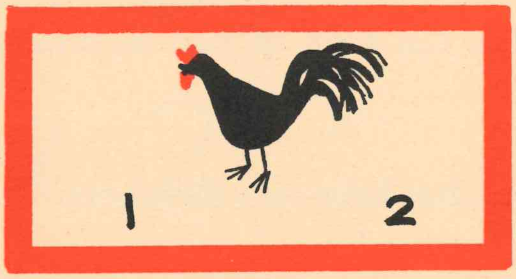
1+1

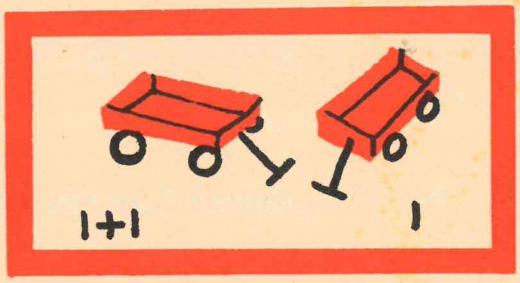
1 + 1 is the same as 2.
1 + 1 is another name for 2.
1 + 1 *renames* 2.

Draw a line around the numeral that names each set.









NOTE: It is important for the child to learn early that a number can be written in many ways. 1 + 1 stands for a set of two, just as much as the numeral 2. (Although the plus sign is introduced, the equals sign is not used yet.)

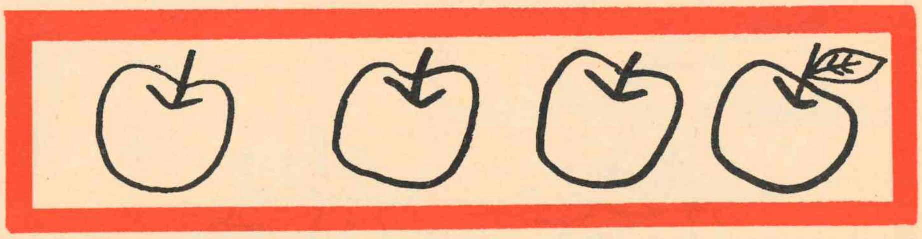
RENAMING TWO

SETS OF TWO

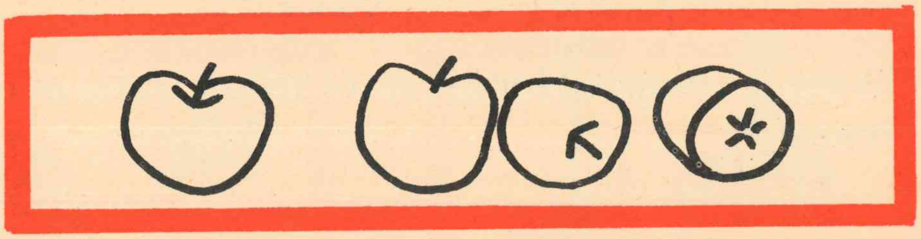
Look at the numeral at the front of each row.

Color the correct number of apples to match the numeral.

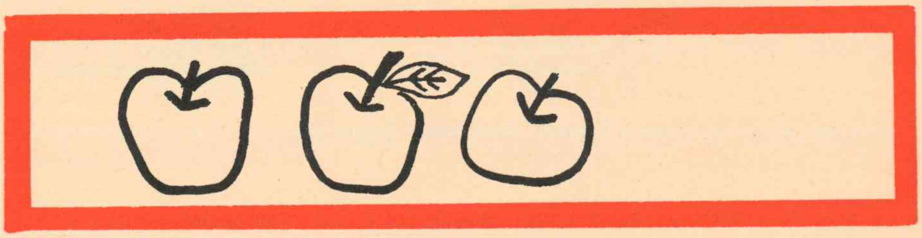
2



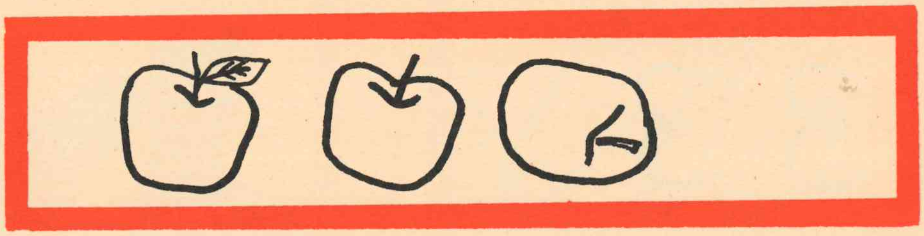
1



1+1



2



NOTE: The number of apples colored in each row should be the same as the numeral which stands for that number at the beginning of the row.

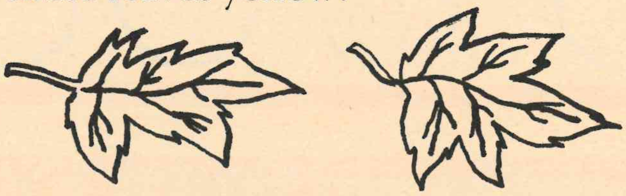
Two apples should be colored in the first row, one in the second row, two (1 + 1) in the third row, and two in the fourth row.

THREE

Color these leaves green.

Write the numeral for the set of green leaves in the number frame.

Color these leaves yellow.



Write the numeral for the set of yellow leaves in the number frame.

Draw one more yellow leaf next to the two yellow leaves.

Now there are three yellow leaves.

The numeral for the number of yellow leaves is written 3. Practice writing 3.

3 3 3 ____ ____ ____ ____

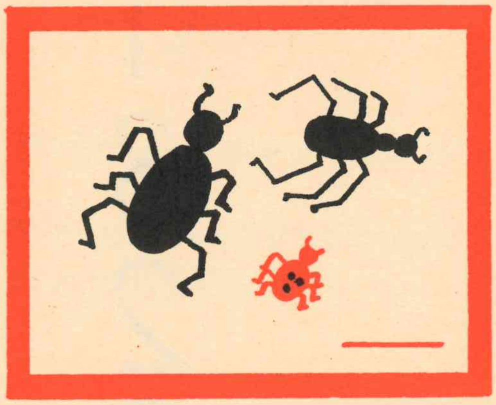
The numeral 3 means 2 and 1 more
or 2 + 1.

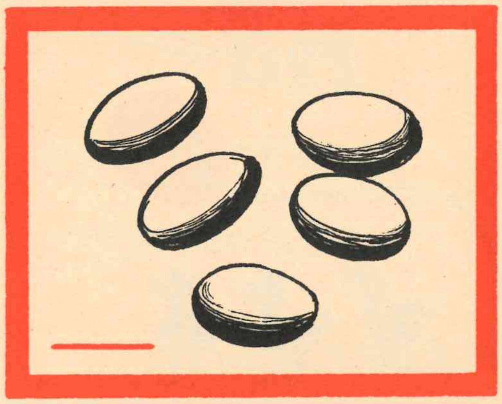
NOTE: 3 stands for the number that is 1 more than 2. Have the child name, or draw, other sets of three.

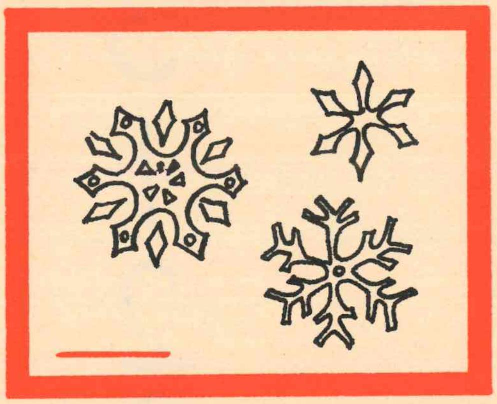
SETS OF THREE

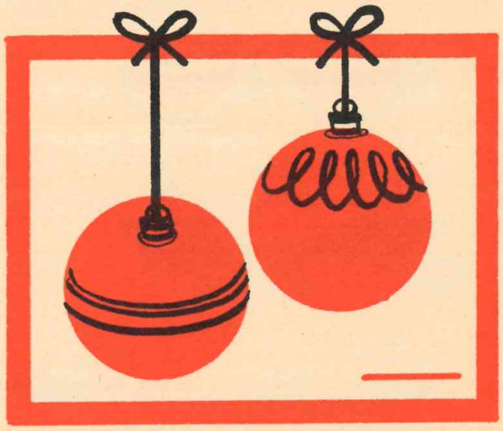
Draw a line around each set with three members.

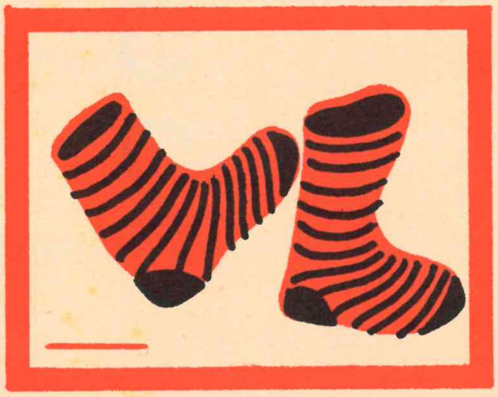
Write 3 with these sets.

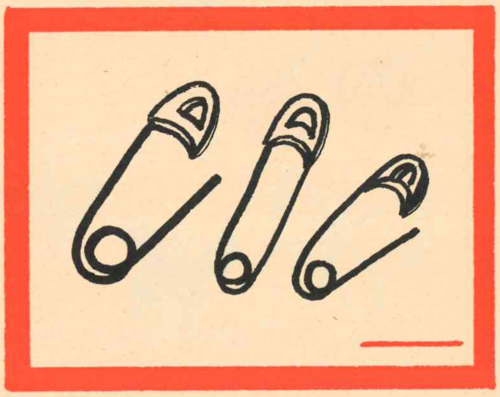








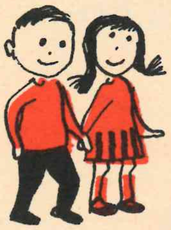


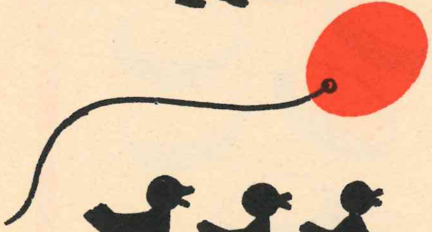


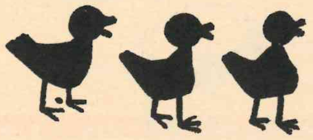
NOTE: The set of bugs, of pins, and of snowflakes should be encircled. The child should be able to recognize a set of three as 2 and 1 more.

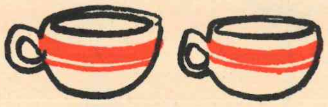
SETS OF ONE, TWO, THREE

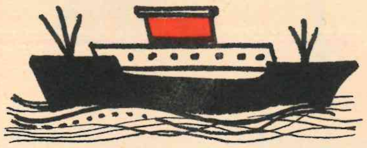
Draw a line from each set to the numeral that names the number of members in the set.

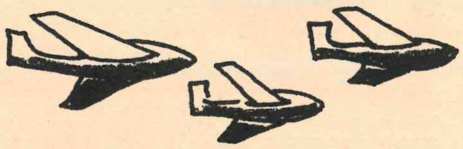


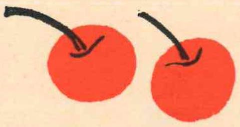


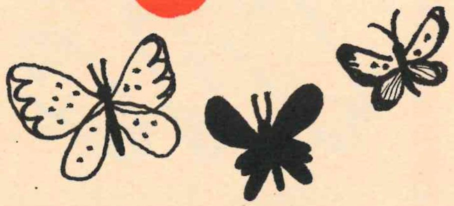












1

3

2

3

1

2

3

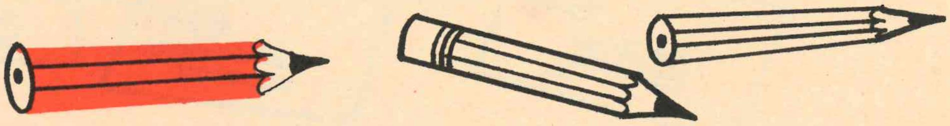
2

NOTE: Remind the child that elements of a set must have a property in common even if the common property is only that the elements are grouped together. The objects do not have to be identical. He should be able to match the set of two children with the numeral 2, etc.

The picture of a set must have the same number as the numeral it stands for.

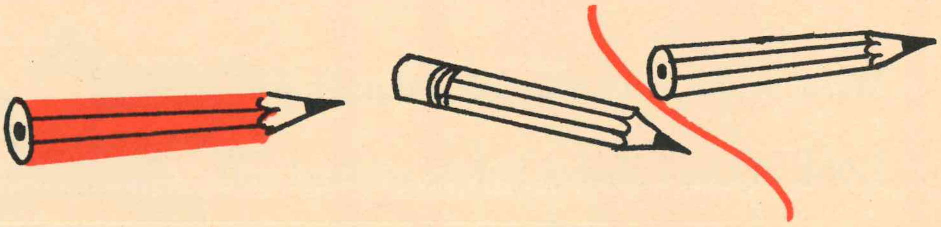
RENAMING THREE SUBSETS

Here is a set of pencils.



Write the numeral for this set in the number frame. □

We can draw a line separating the set of pencils into two parts, like this.



You drew the line to separate the pencils into two parts. Did this change the number of pencils?

Yes ___ No ___

Write the numerals to show how many pencils are in each part.

□ △

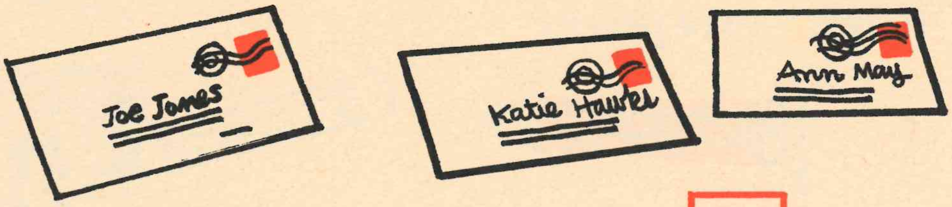
Each part is called a *subset* of the set.

□ + △ is a way of renaming 3.

NOTE: Always read + as *plus,* never *and.* 3 is the same as 2 + 1. They both name the same number of things.

RENAMING THREE

How many members are in this set?

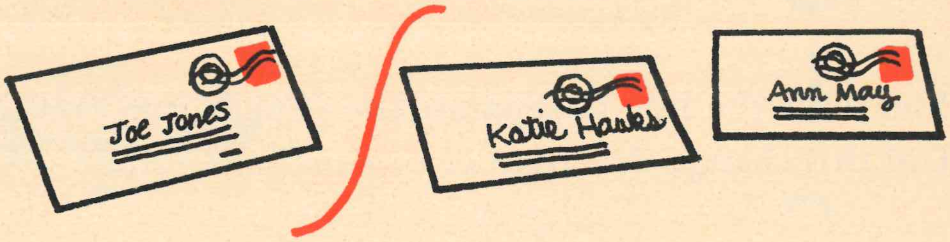


Write the numeral in the number frame. □

We can separate the set into subsets, and rename 3 as 2 + △

What is another way of renaming 3?

Look at the subsets below to find out.



Write the numerals for the subsets here.

△ + ○

Now you know two ways of renaming 3.

△ + ○

○ + △

NOTE: Except for a set containing only 1 element, there is always more than one way to name the number of members in a set.

3 can also be written 2 + 1, or 1 + 2.

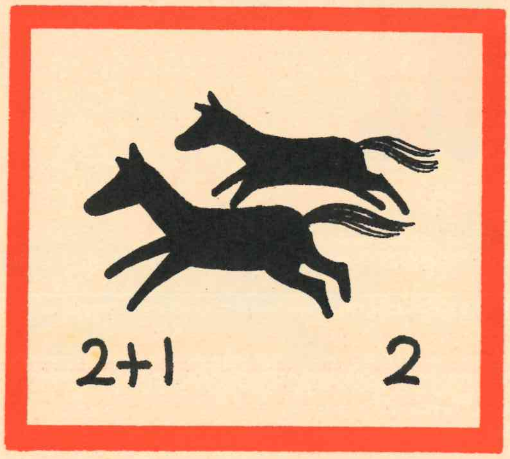
RENAMING THREE
SETS OF THREE

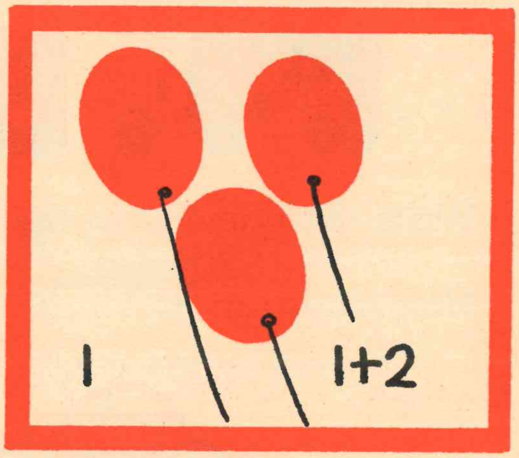
A set of 3 things can be renamed

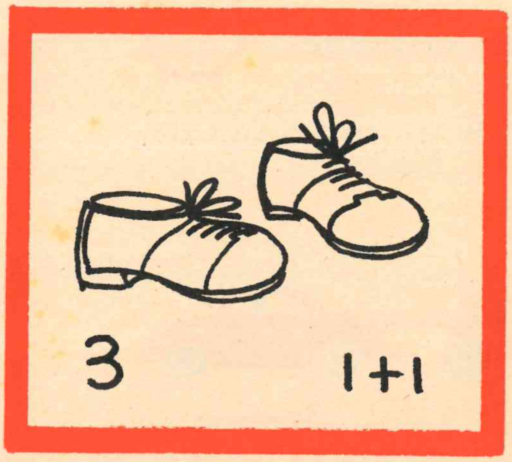
2 + △

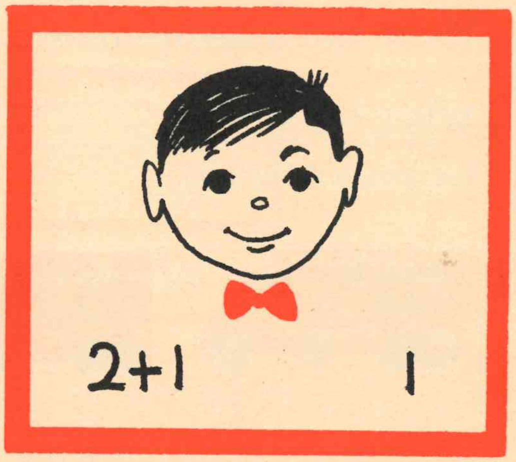
or 1 + ⯃

Draw a line around the numeral that names each set.





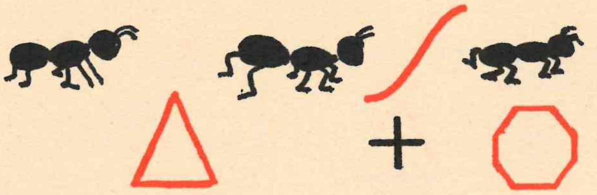




NOTE: Review the fact that numerals name the number of members in a set, and that there are several ways to name a set of three. Separating a set into subsets shows how a number can be renamed.

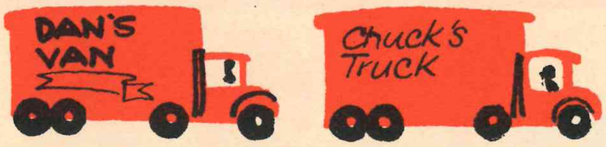
JOINING SETS

A set can be separated into subsets.



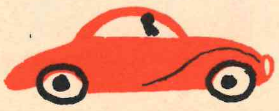
Sets can be joined together, too.

How many trucks are in the set below?



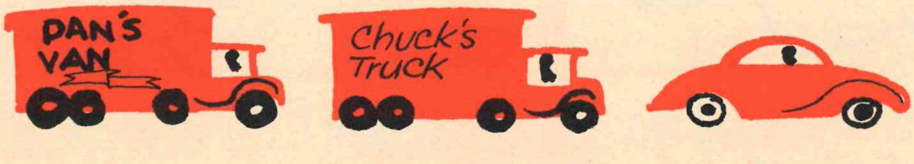
Write the numeral in the number frame. △

How many cars are in the set below?



Write the numeral in the number frame. ⬡

When we join the set of trucks with the set of cars, we get a new set.

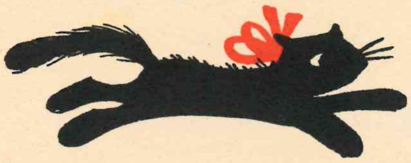


Write the numeral for the new set here. □

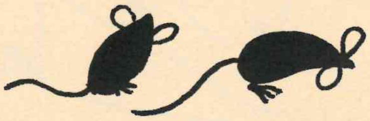
NOTE: Sets are *joined,* never added. Never use a plus sign between sets.

JOINING SETS

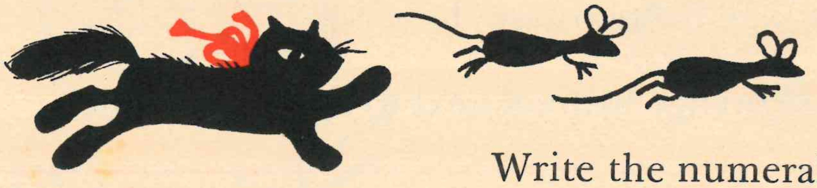
Write the numeral for the set of cats in the number frame.



Write the numeral for the set of mice in the number frame.



When the set of cats is joined to the set of mice, how many members are in the new set?



Write the numeral here.

Draw a set of 2 red balls.

Draw a set of 1 blue ball.

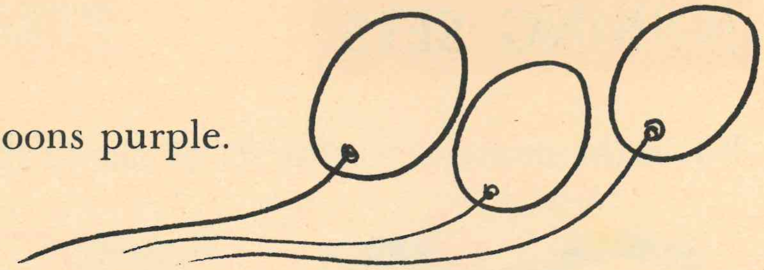
Join the set of red balls and the set of blue balls.

How many balls are in the new set?

NOTE: The operation of joining sets is the foundation for addition.

FOUR

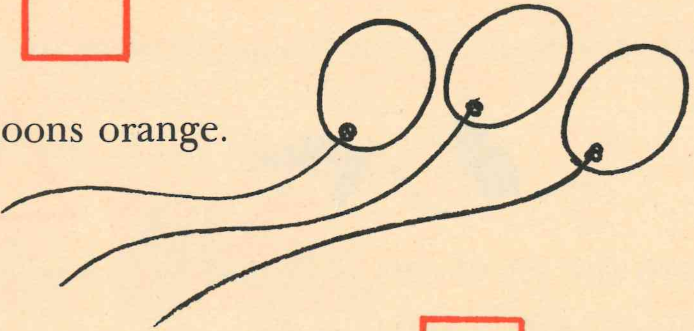
Color these balloons purple.



Write the numeral for the set of purple balloons.

☐

Color these balloons orange.



How many orange balloons are there? ☐

Draw one more orange balloon next to the other orange balloons.

Now there are *four* orange balloons.

The numeral for the number of orange balloons is written **4**.

Practice writing **4**.

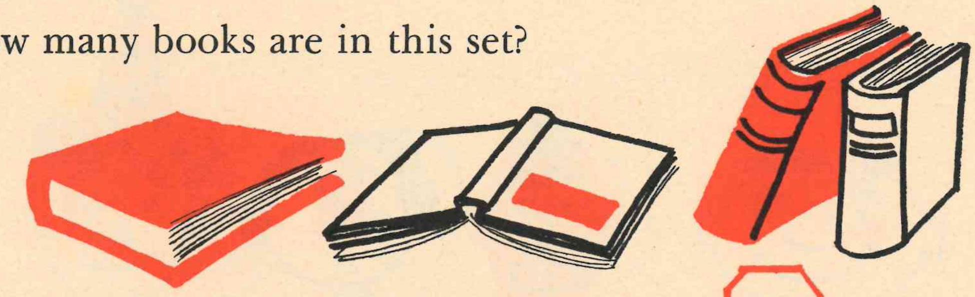
4 4 4 ____ ____ ____ ____

The numeral 4 means 3 and 1 more
or 3 + 1.

NOTE: 4 is the numeral which names a set with four members. Have the child name, or draw, other sets of four.
Point out that the numeral 4 in type is slightly different from the handwritten 4, because the former has a closed top.

SETS OF FOUR

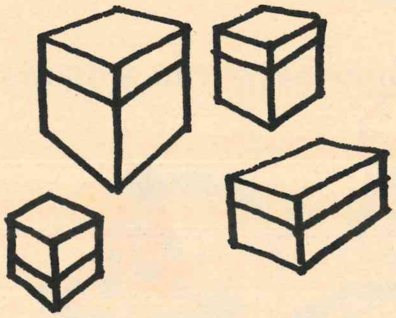
How many books are in this set?

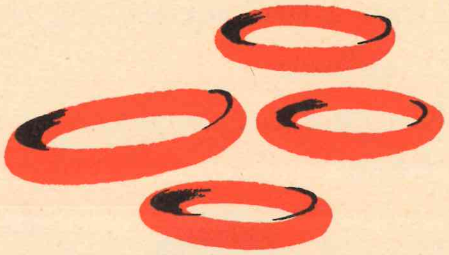


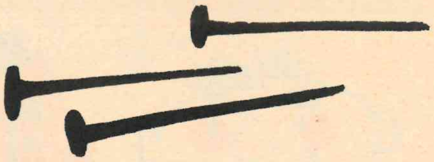
Write the numeral in the number frame.

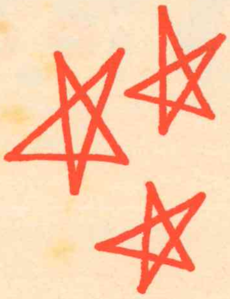
Draw a line around each set with four members.

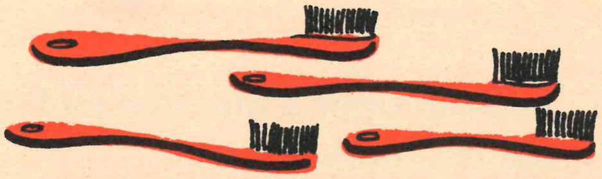
Write 4 with these sets.

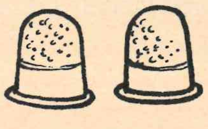












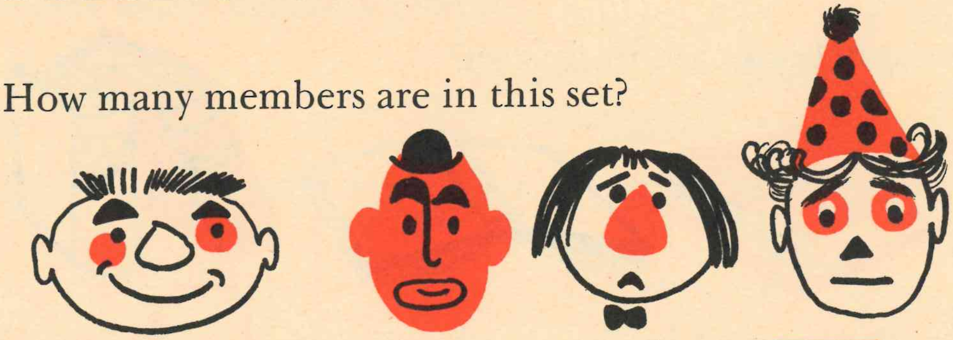
NOTE: The boxes, rings and toothbrushes are all sets of four, and should be circled. The child should realize that the pattern in which the members of the set is drawn does not change the number.

Sometimes, however, the pattern can help with quick recognition of a number, such as 2 and 2, or 3 and 1.

RENAMING FOUR

SUBSETS OF FOUR

How many members are in this set?

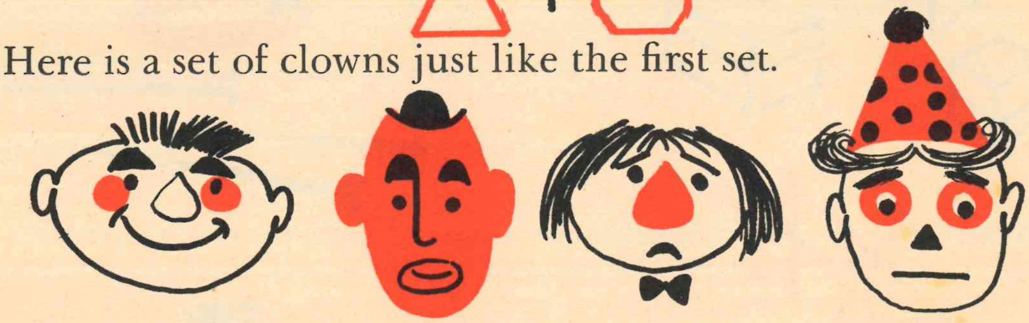


Write the numeral in the number frame. □

Draw a line separating the set of clowns into two parts, or subsets.

Rename the number of clowns to show how you separated the set. △ + ⯃

Here is a set of clowns just like the first set.



You can draw a line that will separate the clowns into subsets another way.

Rename the number of clowns to show how you separated the set this time.

∩ + ◇

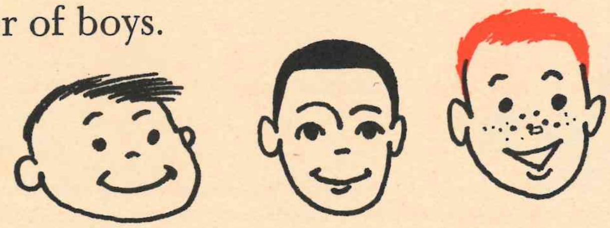
NOTE: 4 can be renamed as 3 + 1, or 1 + 3, or 2 + 2.

Remind the child that these are all ways of renaming 4.

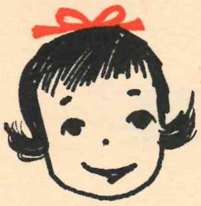
Be sure you use the word *separate,* and not *divide.*

JOINING SETS
UNION OF SETS

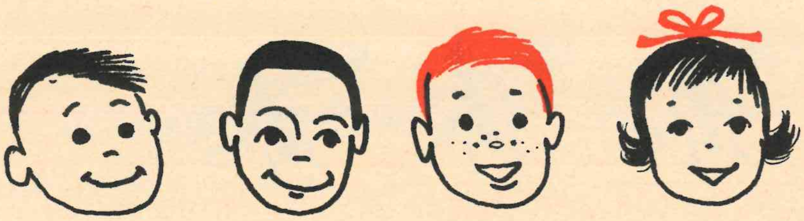
In the number frame, write the numeral for the number of boys.



In the number frame, write the numeral for the number of girls.



Join the set of boys with the set of girls.



What is the number of the new set?

Draw a set of two stars.

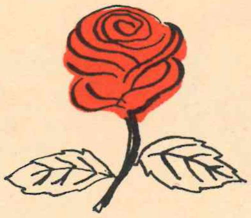
Draw a set of one moon.

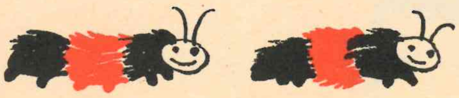
Join the sets.

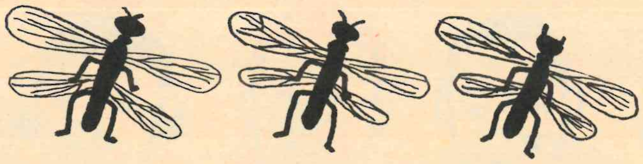
NOTE: "Join" and "union" are both terms used in talking about sets. The child may want to practice drawing other sets and joining them.

COUNTING TO FOUR

Here are some sets.

___  ___

___  ___

___  ___

In front of each set, write the numeral that tells the number of elements in the set.

After each set, on the same line, draw one more of the elements in the set.

At the end of each line, write the numeral that shows how many elements are in the set now.

NOTE: The concept of "one more" leads to the idea of order in the set of counting numbers, sometimes called the set of natural numbers.

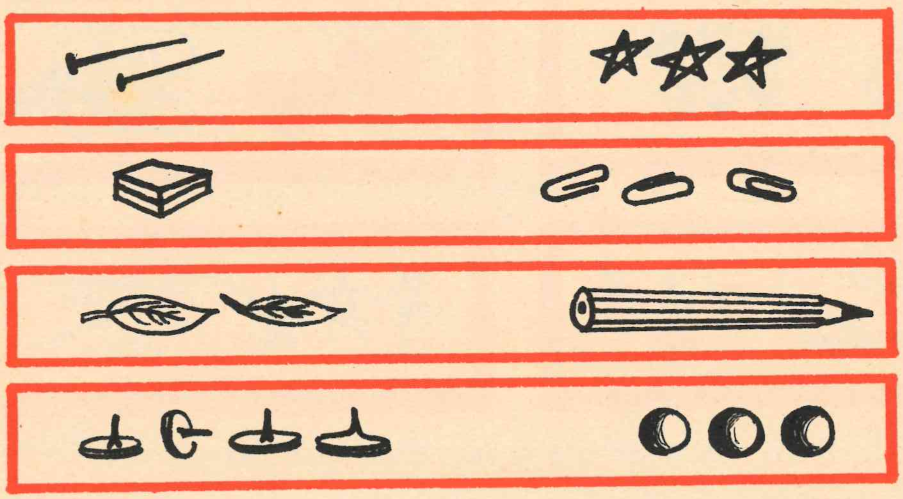
Each number is one more than the one before it.

The child may realize that the set of 4 contains all the sets through 4.

NUMBER SENTENCES

IS GREATER THAN

Draw a line around the set in each row which has more elements.



We say that the larger set *is greater than* the smaller set.

There is an easy way to write *is greater than.*

The sign looks like this: >

The number sentence 3 > 1 is read

"Three is greater than one."

The number sentence 4 > 1 is read

"Four is greater than one."

The number sentence 4 > 2 is read

"Four is greater than two."

Finish these number sentences so they are true.

3 > ☐

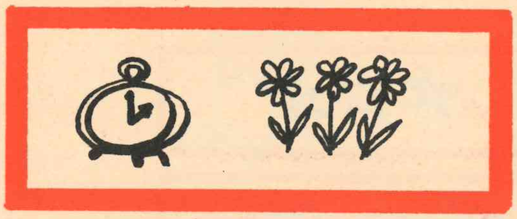
4 > ☐

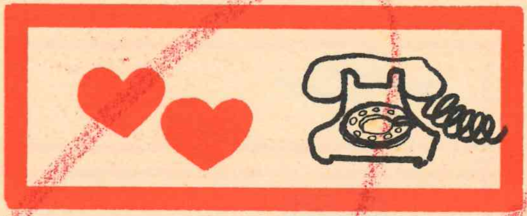
2 > ☐

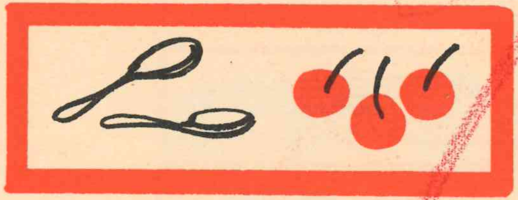
NOTE: A number sentence is sometimes called a mathematical statement. It is just like a sentence in English, except that it uses numerals, signs, and sometimes letters, instead of words.

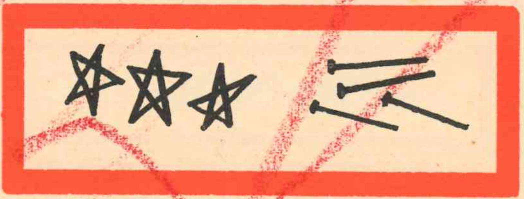
NUMBER SENTENCES
IS LESS THAN

Draw a line around the set in each box which has fewer elements.









We say that the smaller set *is less than* the larger set.
There is an easy way to write *is less than*.
This is the sign: <
The numeral before the sign must stand for a smaller number than the numeral after the sign.
The number sentence 1 < 2 is read
"One is less than two."
The number sentence 1 < 3 is read
"One is less than three."
The number sentence 1 < 4 is read
"One is less than four."
Finish these number sentences so they are true.

3 < ☐
2 < ☐
2 < ☐

NOTE: Three is less than four; two is less than three; two is less than four.
This is another kind of number sentence.
Both *is greater than* and *is less than* show a relationship between numbers.

RELATIONSHIPS BETWEEN NUMBERS

REVIEW

What is the sign for *is greater than*?

Write it here. ○

What is the sign for *is less than*?

Write it here. ○

Both these signs are used to make number sentences. Fill in the following number sentences with

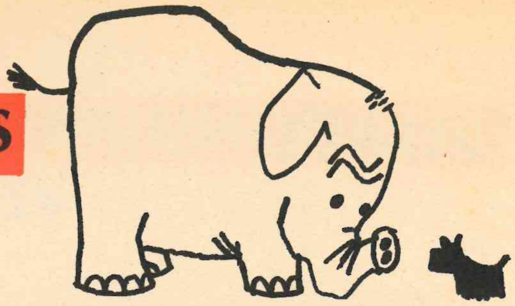
the sign *is greater than* >
or the sign *is less than* <
so that the sentences are true.

3 2	1 2
4 2	3 4
1 3	4 1
2 3	2 1

NOTE: When completed, the sentences should look like this: 3 > 2; 4 > 2; 1 < 3; 2 < 3; 1 < 2; 3 < 4; 4 > 1; 2 > 1.

Numerals by now should so clearly represent a number of objects that the relationship between 1, 2, 3 and 4 is grasped without counting.

NUMBER SENTENCES
INEQUALITIES



We have talked about number sentences where one number is less than the other, like 2 < 3.
Write another sentence using <.

<

We have talked about number sentences where one number is greater than the other, like 3 > 1.
Write another sentence using >.

>

A sentence using < or > is called an *inequality.*

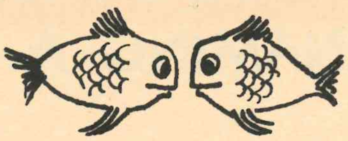
The numerals do not stand for the same number.

Draw two sets that do not contain the same number of members.

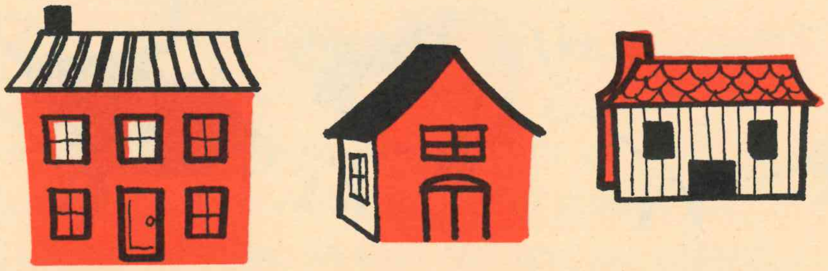
Write a number sentence about the two sets.

NOTE: Inequalities show a relationship between numbers.
The child must realize that the numerals merely represent the number of objects in the sets.

NUMBER SENTENCES
EQUALS



An inequality is one kind of number sentence.
There is another kind of number sentence.
It has numerals that stand for the same number of things.
Write the numeral for the number of houses in the set below.



☐

Draw a line separating the set of houses into two subsets.

Show a way of renaming the number of houses in the set by filling in the number frames.

△ + ○

2 + 1 and 1 + 2 name the same number as 3. We say that
2 + 1 and 1 + 2 and 3 are *equal*.
The sign for the word *equals* is written =.

2 + 1 = 3 is read
"Two plus one equals three."

You can rename the set of houses another way.
Finish this number sentence. ○ + 2 = 3

NOTE: Addition facts are introduced as a way of renaming the same number.

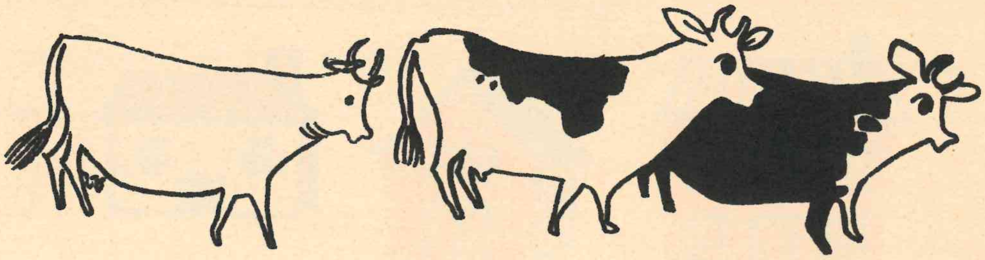
EQUATIONS

RENAMING A NUMBER

A number sentence using an equals sign is called an *equation.*

The numerals on both sides of the equals sign must name the same number.

The number of members in the set



can be written 3

or 2 + 1

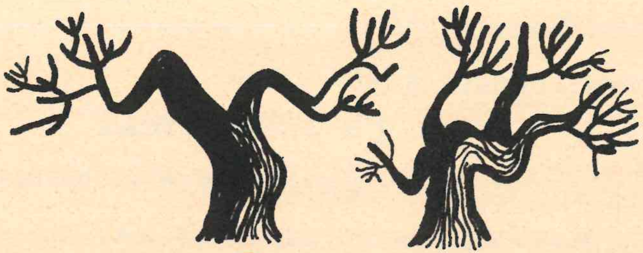
or 1 + 2

Finish the equations for the set of cows.

2 + 1 = ☐

1 + 2 = ☐

Finish the equation for this set.



$\boxed{1} + \boxed{\ } = \bigcirc$

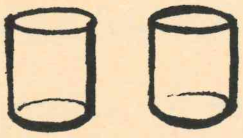
NOTE: Addition facts should be learned so that any missing numerals can be filled in to form an equation.

This concept is carried over when studying algebra.

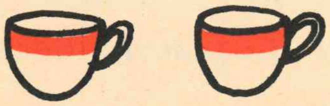
EQUATIONS

JOINING SETS

When two sets are joined, we can write an equation about it.



Write the numeral for the number of glasses. ☐



Write the numeral for the number of cups. ☐

Make a new set, drawing the set of glasses
and the set of cups, so that the sets are joined.

☐ ☐

When you join a set of two members with a set of two members, how many members are in your new set?

☐

When you join two sets, you can show the number of the new set with an equation.

2+2=4

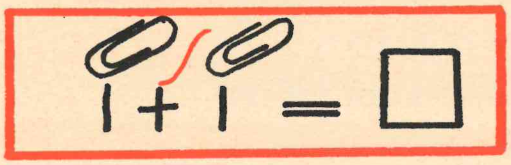
NOTE: The child has now seen how an equation can be developed by joining two sets.

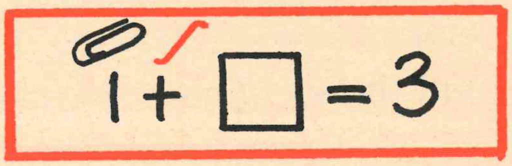
PLACEHOLDERS IN NUMBER SENTENCES

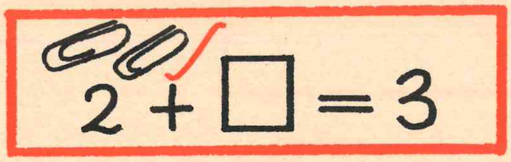
In a number sentence, the number frame which shows where a numeral should be written is called a *placeholder*.

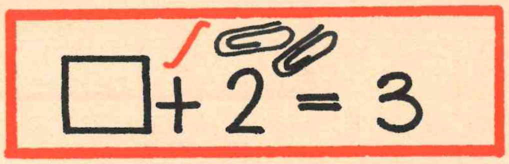
A placeholder holds the place for a numeral in a number sentence.

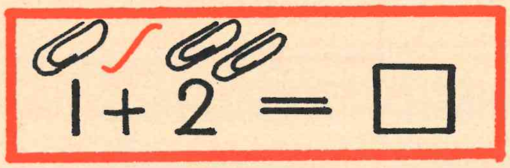
Draw the number of paper clips missing in the sets below. Then write the numeral in the placeholder to finish the equation.

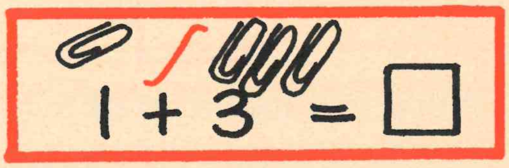

$1 + 1 = \square$

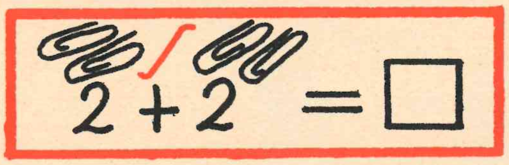

$1 + \square = 3$

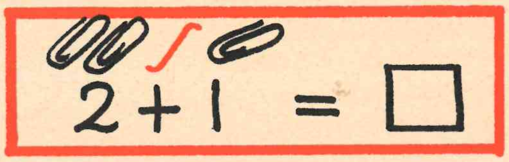

$2 + \square = 3$

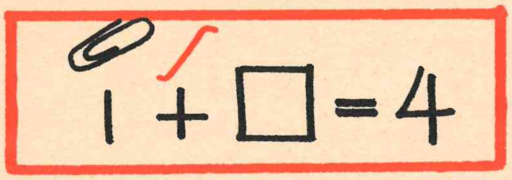

$\square + 2 = 3$

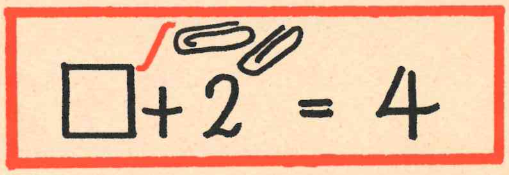

$1 + 2 = \square$


$1 + 3 = \square$


$2 + 2 = \square$


$2 + 1 = \square$


$1 + \square = 4$


$\square + 2 = 4$

NOTE: The child should see that the numerals in an equation picture the union of sets, or the renaming of a number.

EQUATIONS

ADDITION FACTS TO 4

Equations are one kind of number sentence.

Fill in the placeholders with the numerals to make the equations true.

Each side of the equation should name the same number.

$3+1=\square$

$2+2=\square$

$1+3=\square$

$1+2=\square$

$2+1=\square$

$1+1=\square$

$1+\square=3$

$\square+2=4$

$3+\square=4$

$1+\square=2$

$\square+2=3$

$\square+1=3$

NOTE: Here are all the addition facts through 4. The concept of zero, and equations using 0, are not introduced in this book.

The child should understand that the numerals on one side of the equation merely rename the number which is on the other side, and that the equals sign actually shows equality.

INEQUALITIES
RELATIONS OF NUMBERS TO 4

These number sentences are all inequalities.
Fill in the correct sign
is greater than >
or is less than <
so that the number sentences are true.
The first sentence is done for you.

1 < 2   3   1

2   3   4   2

3   4   1   3

4   3   4   1

3   2   3   4

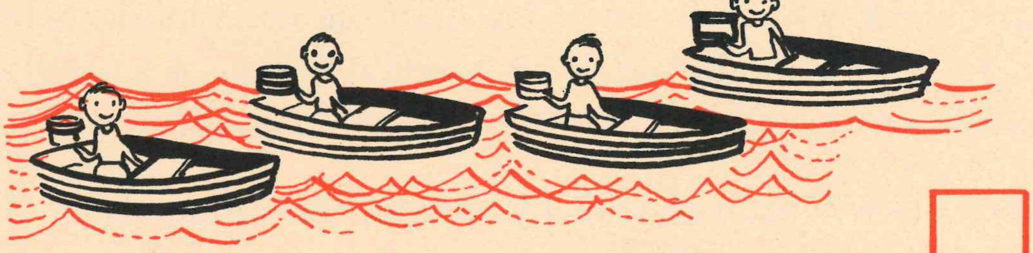
2   1   4   3

NOTE: The child may notice that, in the first column, each number is one less than, or one more than, the second number in the sentence.

The second column gives further practice in deciding which numeral stands for the greater, or the smaller, quantity.

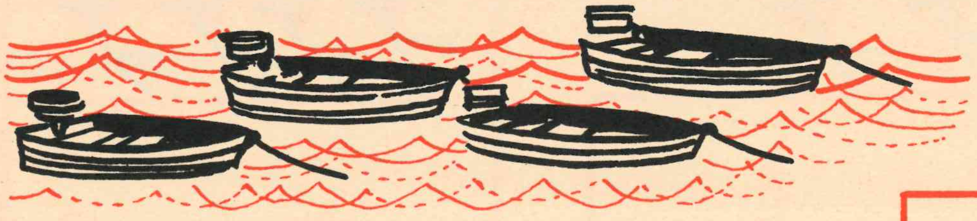
FIVE

Color these boats blue.



Write the numeral for the set of blue boats here. ☐

Color these boats red.



Write the numeral for the set of red boats here. ☐

Draw one more red boat next to the other red boats.

Now there are *five* red boats.

The numeral for the number of red boats is written 5.

Practice writing 5.

5 5 5 ____ ____ ____ ____

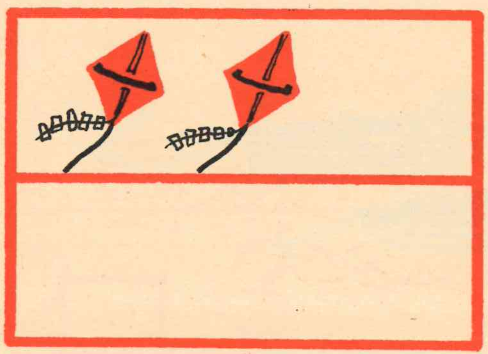
NOTE: For all sets containing five elements, the child should be able to recognize the number of elements in the set instantly, without counting.

Have the child name, or draw, other sets of five elements (5 fingers, 5 toes, 5 pennies, etc.).

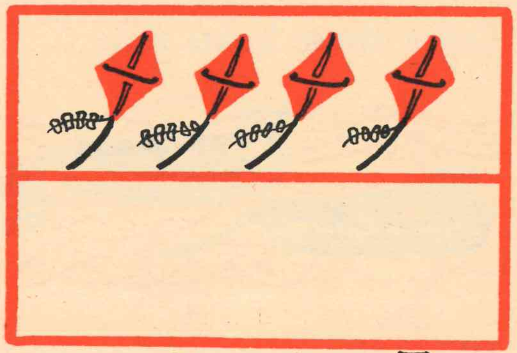
JOINING SETS TO MAKE 5

Each block contains a set of kites. In the same block, below the line, draw another set of kites so that the two sets together contain five members.

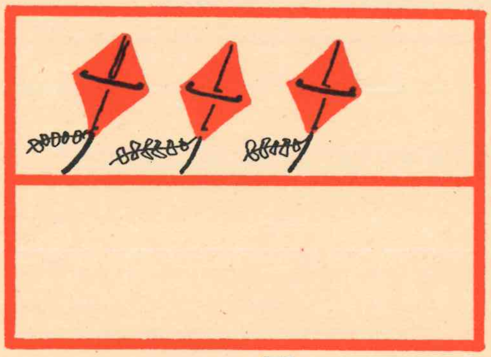
Then show what you did, by writing the numerals in the placeholders to finish the equation.



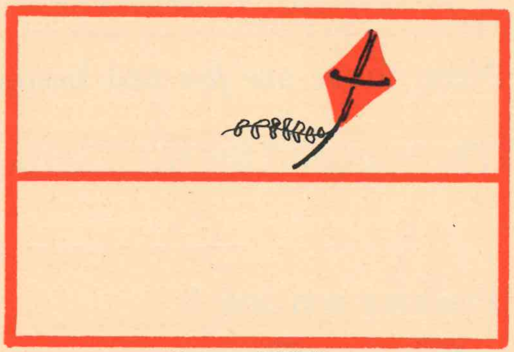
2+ △ = 5



4+ ◇ =5



3+ ⬡ = 5



1+ ▽ =5

Be sure the numbers in the equations make a sum of 5, just as the union of the two sets in each block makes five members.

NOTE: Using the counting numbers already learned, a set of 5 can be made 4 ways. Each equation is an addition fact about 5, representing the union of two sets.

RENAMING 5
ADDITION FACTS TO 5

Draw a set with five members.

The numeral 5 means
4 and 1 more
or 4 + 1.

Separate the set you drew into two subsets.

How many equations can you make by separating the set of five members into different subsets? Each time you are renaming 5.

□ + △ = 5
□ + △ = 5
□ + △ = 5
□ + △ = 5

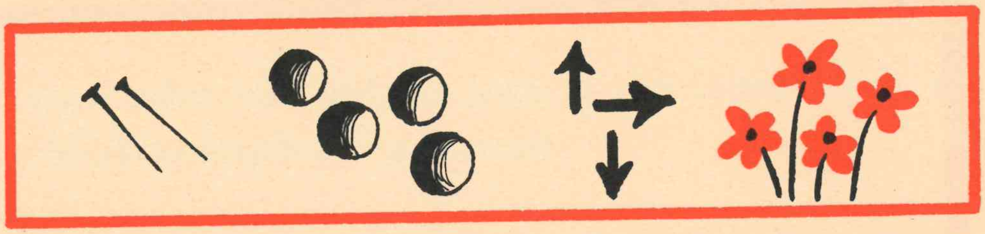
NOTE: By renaming 5, the child should be able to develop all the addition facts for 5.

1 + 4 =5
4 + 1 = 5
3 + 2 = 5
2 + 3 = 5

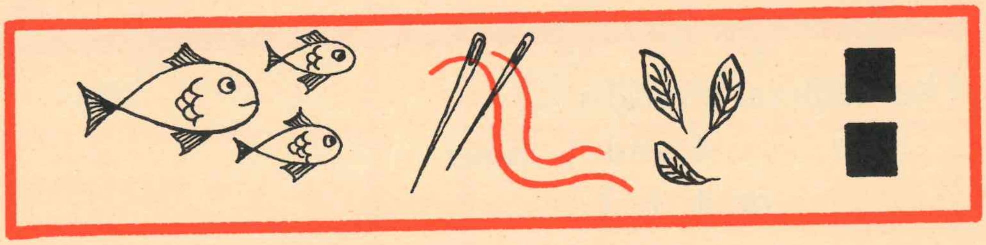
RECOGNIZING SETS TO 5

Look at the numeral at the front of each row. Draw a line around each set which has that many members.

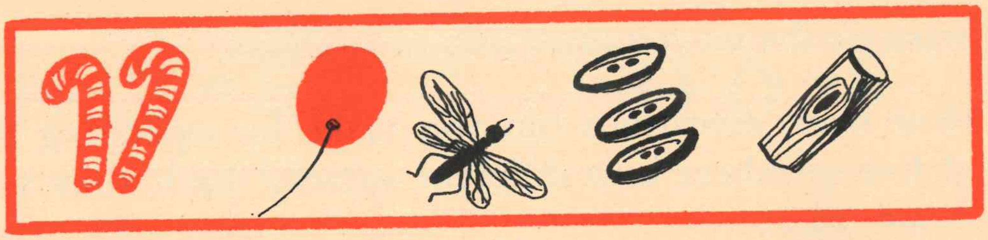
4



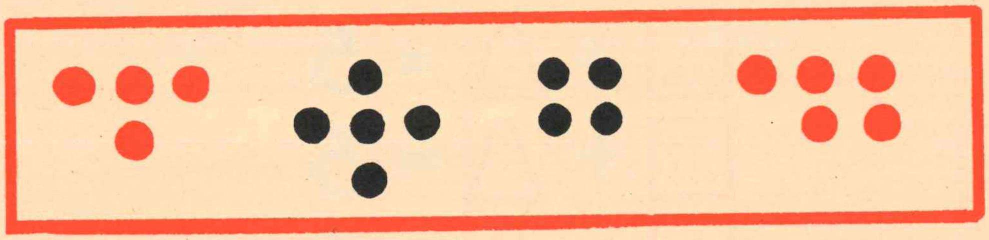
2



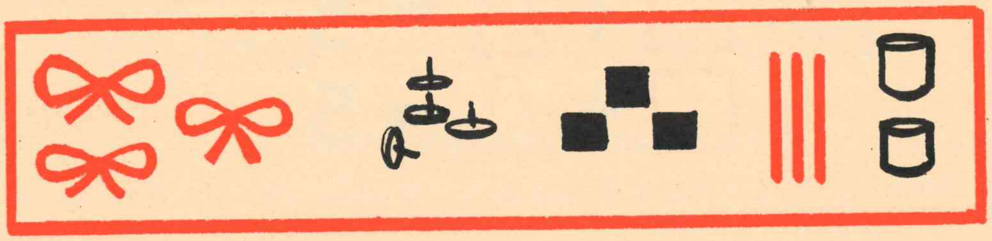
1



5



3



NOTE: The child should always keep in mind that a numeral stands for a certain number of objects. He should also recognize that each number contains the set of all numbers less than itself.

SET OF COUNTING NUMBERS TO 5

Fill in the number frames below with the numerals that are missing.

1 □ 3 4 ◇

These numerals name the first five numbers in the set of counting numbers.

Write the first five counting numbers below.

_____ _____ _____ _____ _____

The last numeral in the set tells how many members you have counted.

On the lines below, begin with 1 and write the numerals to show counting.

_____ _____ _____ _____

The last numeral you wrote was 4. This tells us that there are four members in that set of numbers.

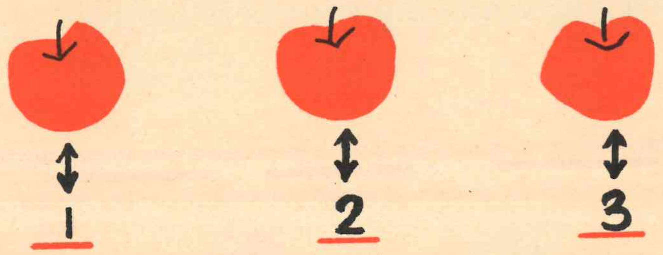
NOTE: The child should be aware of the fact that the numbers which are used for counting, beginning with 1, make up the set of counting numbers, sometimes called the set of natural numbers. Each number is one more than the one before it.

MATCHING SETS WITH THE SET OF COUNTING NUMBERS

Write the first five numerals in the set of counting numbers.

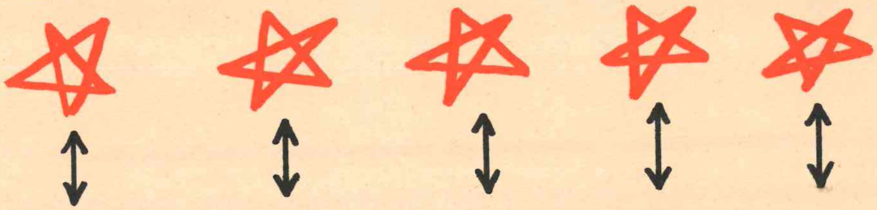
_____ _____ _____ _____ _____

Each member of a set of objects can be matched one-to-one with the set of counting numbers, like this.



The last number you name in counting the members of a set is the *cardinal number* of the set. The cardinal number tells us how many are in the set.

Match the set of stars with the set of counting numbers.



___ ___ ___ ___ ___

What is the cardinal number of the set of stars? ☐

NOTE: Although children should be able to recognize sets through 5 without counting, sets containing more than 5 elements should be counted.

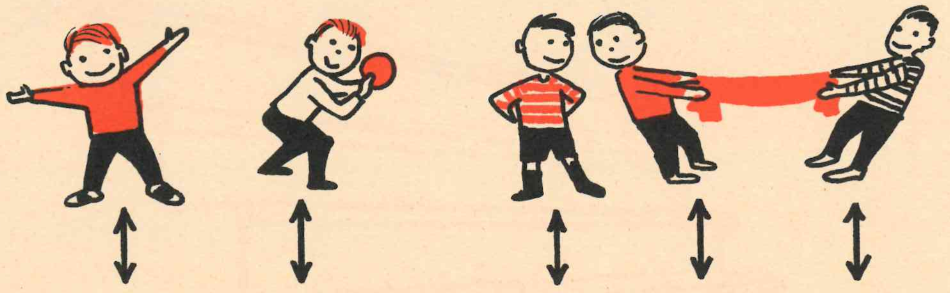
Counting is actually a process of matching elements one-to-one with the set of counting numbers.

The cardinal number of the set tells "how many."

MATCHING SETS WITH COUNTING NUMBERS

CARDINAL NUMBER

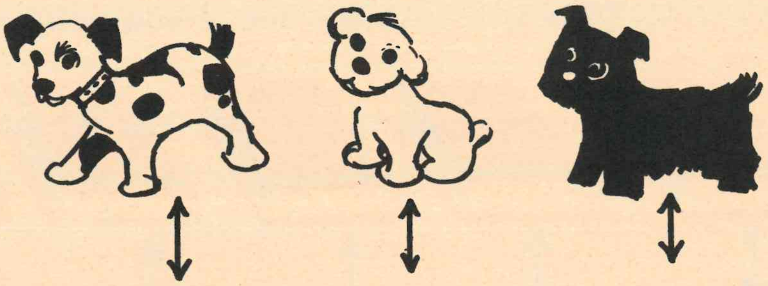
Match the set of boys with the set of counting numbers.



___ ___ ___ ___ ___

Write the numeral which names the cardinal number of the set of boys. ☐

Match the set of dogs with the set of counting numbers.



___ ___ ___

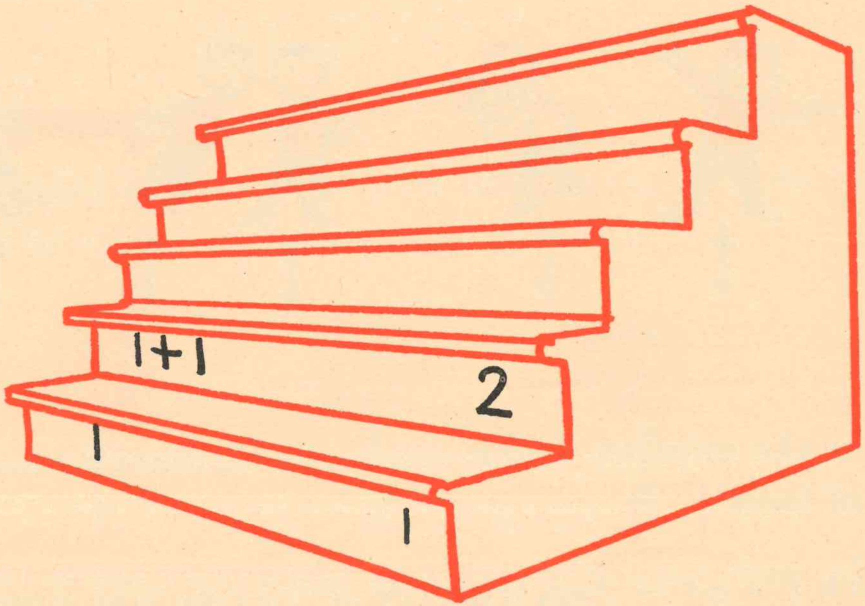
Write the numeral which names the cardinal number of the set of dogs. ☐

NOTE: By now, the child should be able to tell that the last numeral matched to a set is the cardinal number of the set.

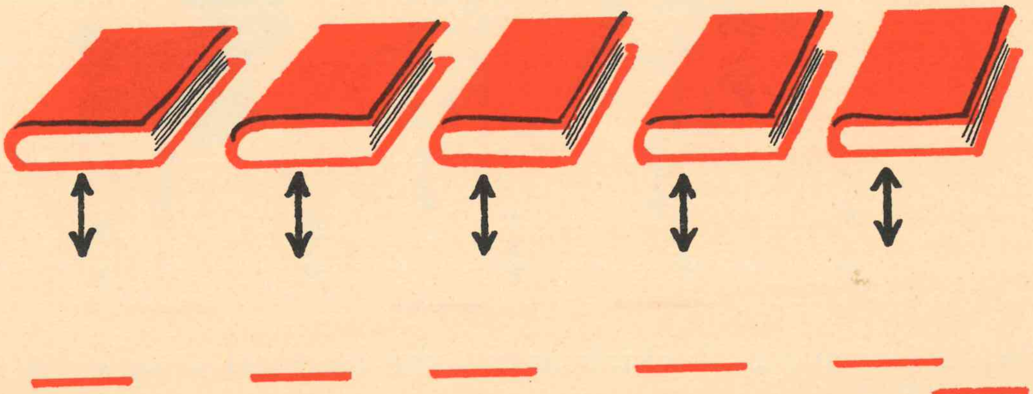
SETS OF COUNTING NUMBERS TO 5

CARDINAL NUMBER TO 5

On each step add 1 to the number on the lower step. Show another way of naming the number.



Match the set of books with the set of counting numbers.



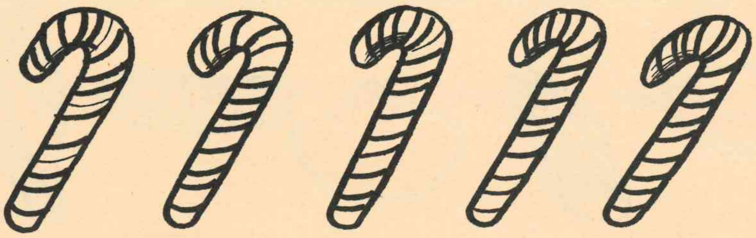
Write the cardinal number of the set of books. ☐

NOTE: Review the concept of "one more" for the set of counting numbers.

Also review the idea that the cardinal number of the set is the last numeral used when the elements are matched with the set of counting numbers.

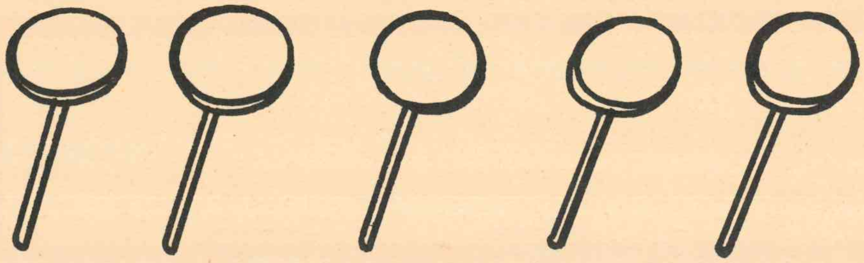
SIX

Color these candy sticks red.



Write the numeral for the set of red candy sticks. ☐

Color these lollipops green.



Write the numeral for the set of green lollipops. ☐

Draw one more green lollipop next to the set of green lollipops.

Now there are *six* green lollipops.

The numeral for the number of green lollipops is written 6.

Practice writing the numeral 6.

6 6 6 ___ ___ ___ ___

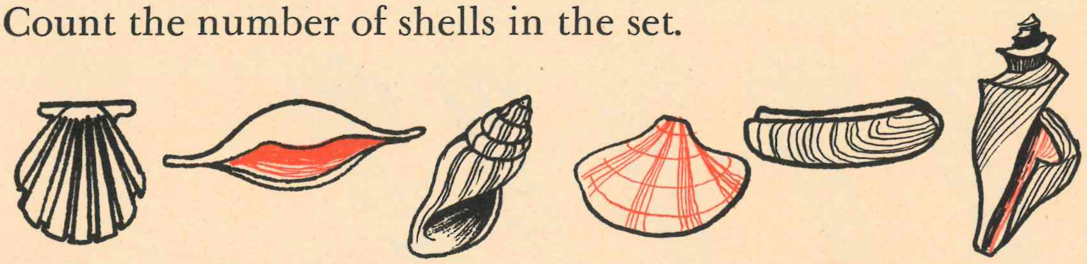
The numeral 6 means 5 and 1 more
or 5 + 1.

NOTE: Have the child name, or draw, other sets of six elements.

SETS OF SIX

NUMBER PATTERNS

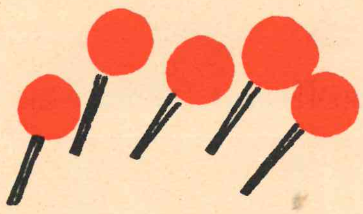
Count the number of shells in the set.

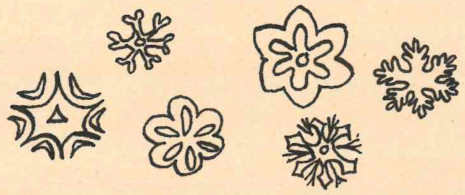


Write the numeral for the set of shells here. ☐

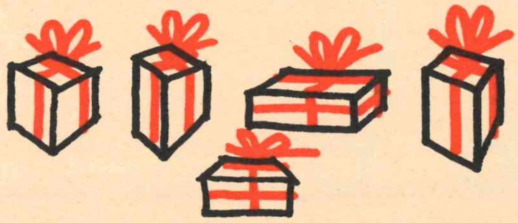
Draw a set with six flowers.

Draw a line around each set with six members.





aaa
aaa



Write the numeral 6 beneath the sets with six members.

NOTE: The child should be able to separate a set into subsets. Have him point out some of the subsets.

RENAMING 6
SUBSETS

Draw a set with six members.

Separate the set of six members into any two subsets.

Rename 6.

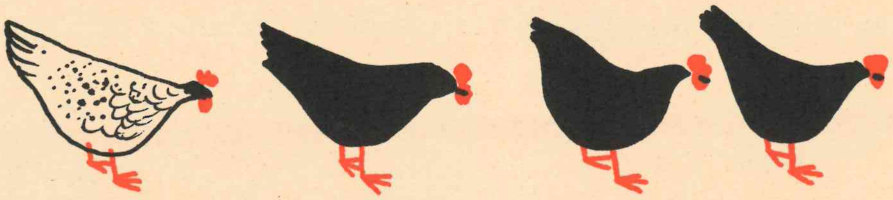
1 + $\boxed{5}$	$\boxed{5}$ + 1
2 + ☐	☐ + 2
3 + ☐	☐ + 3
4 + ☐	☐ + 4
5 + ☐	☐ + 5

NOTE: Within a set of 6, the child should be able to identify sets of:

1 + 5	5 + 1
2 + 4	4 + 2
3 + 3	3 + 3
4 + 2	2 + 4
5 + 1	1 + 5

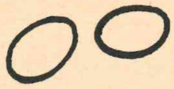
JOINING SETS TO MAKE 6

Write the numeral for the set of hens.



◇

Write the numeral for the set of eggs.



□

In the space below, join the set of hens with the set of eggs.

Write the numeral for the new set. ⯃

Finish the equation to show joining the two sets.

◇ + □ = ⯃

In the space below, draw two sets which are joined together to make six members.

Finish the equation. △ + ▽ = 6

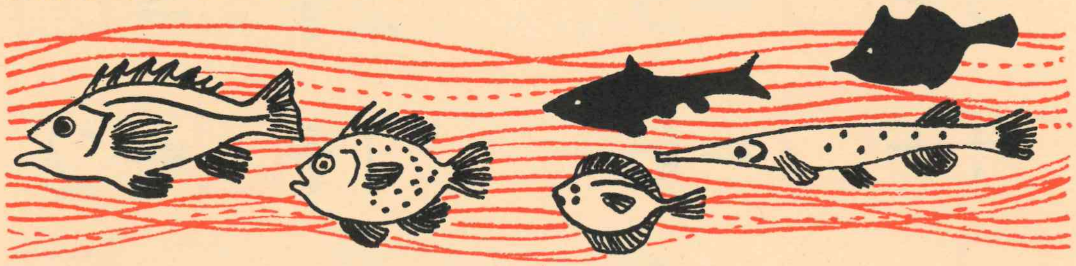
NOTE: An equation can show the union of two sets.

EQUATIONS

ADDITION FACTS FOR 6

Six can be renamed many different ways.

Here is a set of 6 fishes:



By renaming 6, finish all the equations.

1+□=6 2+△=6 3+◇=6

5+○=6 4+▽=6

The number sentences below are all inequalities.

Finish the sentences by filling in the correct sign.

5<6 4 3 4 5

6 3 3 5 2 6

5 2 2 4 6 4

6 5 6 1 5 3

NOTE: Here are two kinds of number sentences.

The first part of the page gives all the equations for 6.

The second part of the page shows relationships between numbers through 6.

REVIEW OF ADDITION FACTS TO 6

Fill in all the placeholders to make true number sentences.

$3 + \square = 5$

$4 + \square = 6$

$\square + 5 = 6$

$2 + 3 = \square$

$1 + \square = 3$

$2 + \square = 5$

$\square + 3 = 4$

$1 + \square = 4$

$2 + 1 = \square$

$1 + \square = 2$

$2 + 4 = \square$

$5 + \square = 6$

$\square + 3 = 6$

$4 + 1 = \square$

$3 + \square = 4$

$2 + \square = 6$

NOTE: This is a review of all the addition facts through 6. If the child has forgotten any of the equations, having him draw a set of objects to find out what numerals should be written in the placeholder. Remind him that the numeral or numerals on both sides of the equation name the same number of things.

COUNTING NUMBERS TO 6

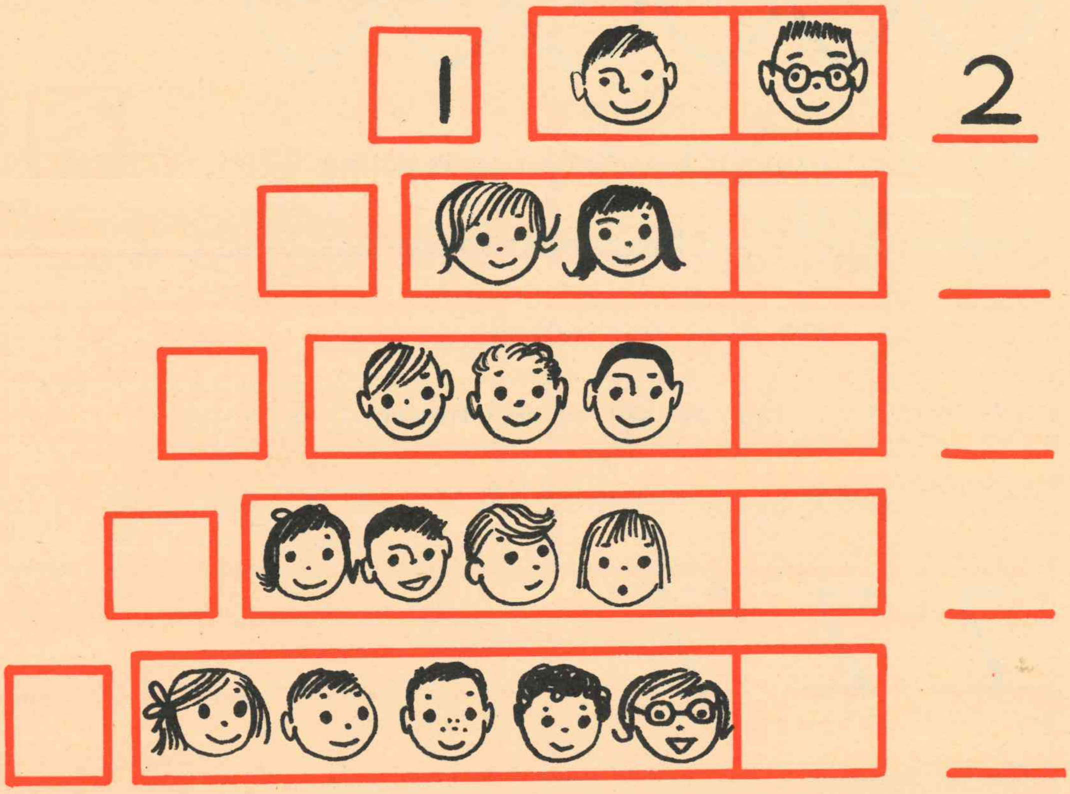
RENAMING NUMBERS TO 6

In each number frame, write the numeral for the set of faces in that row.

Then draw one more face with each set.

On the line, write the cardinal number of each new set you have made.

The first one has been done for you.

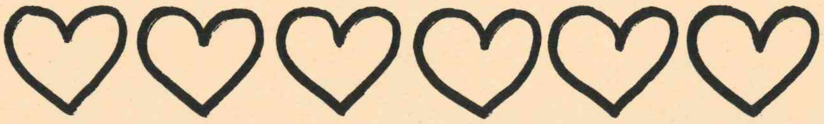


NOTE: Review the "one more" pattern of the set of counting numbers. The order of the numbers from 1 through 6 should be recalled.

Sets larger than 5 should be counted.

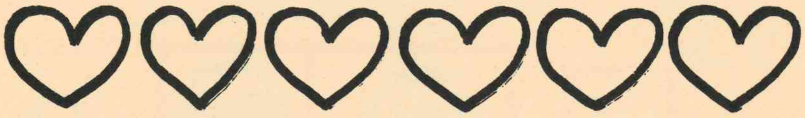
SEVEN

Color these hearts blue.



Write the numeral for the set of blue hearts. ☐

Color these hearts red.



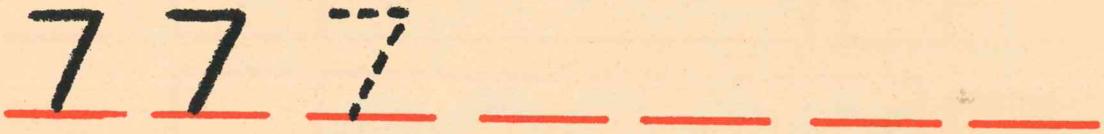
Write the numeral for the set of red hearts. ☐

Draw one more red heart next to the set of red hearts.

Now there are *seven* red hearts.

The numeral for the set of red hearts is written 7.

Practice writing the numeral 7.



The numeral 7 means 6 and 1 more
or 6 + 1.

NOTE: Have the child name, or draw, other sets of seven elements. He should understand that because 7 is one more than 6, 7 is the counting number that follows 6.

RENAMING SEVEN

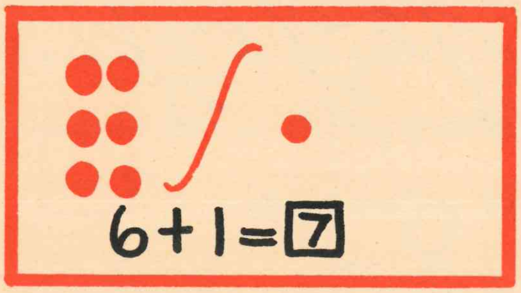
We have said that 6 + 1 is another way of naming 7.

Finish the equation which says this.

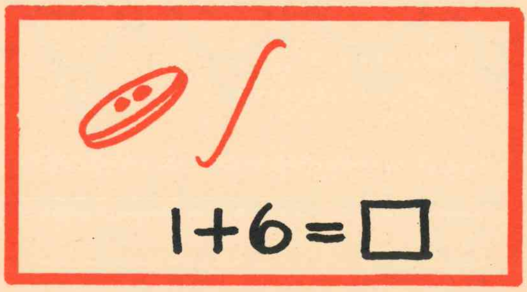
$$6+1=\square$$

In each box below, draw another set so that the two sets together have 7 members. Finish each equation.

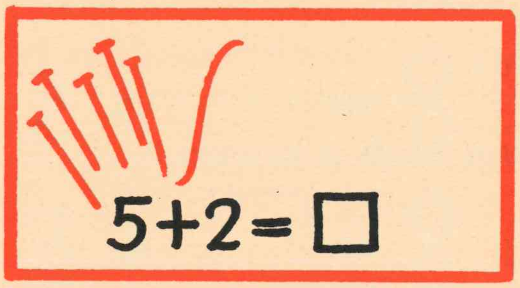
The first one is done for you.



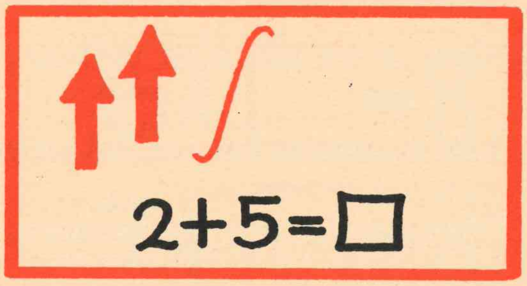
$6+1=\boxed{7}$



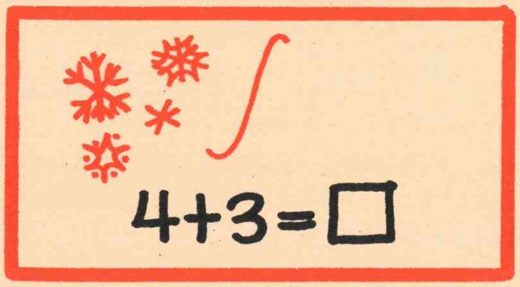
$1+6=\square$



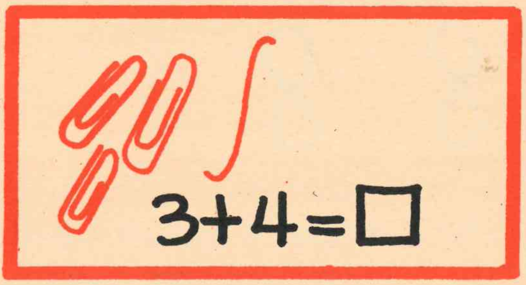
$5+2=\square$



$2+5=\square$



$4+3=\square$

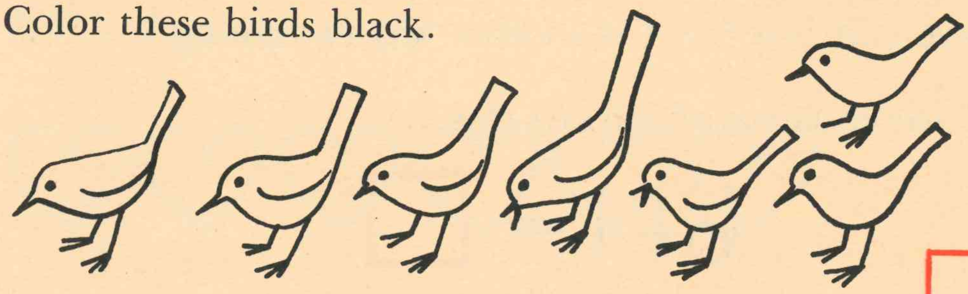


$3+4=\square$

NOTE: This page develops all the addition facts for 7. It provides practice for strengthening the concept that a numeral stands for a number. It also shows that a set of 7 things can be made by joining two sets.

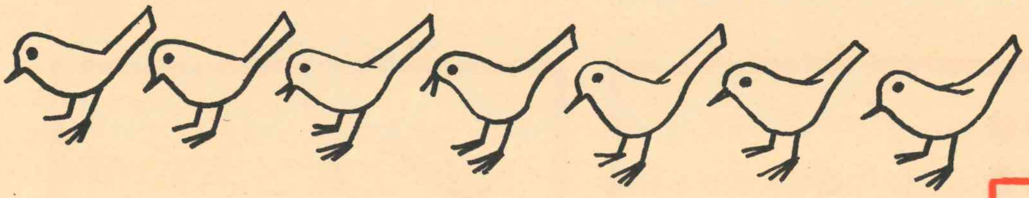
EIGHT

Color these birds black.



Write the numeral for the set of black birds. ☐

Color these birds yellow.



Write the numeral for the set of yellow birds. ☐

Draw one more yellow bird, next to the other yellow birds.

Now there are *eight* yellow birds.

The numeral for the set of yellow birds is written 8.

Practice writing the numeral 8.

8 8 ___ ___ ___ ___ ___

The numeral 8 means 7 and 1 more
or 7 + 1.

NOTE: Have the child point out, or draw, other sets of eight elements. Have him match the set of 8 he has drawn with the set of counting numbers from 1 to 8. The cardinal number of each set is 8.

RENAMING EIGHT

ADDITION FACTS FOR EIGHT

Draw a set with eight members.

Separate the set into two subsets.

Rename 8 in all the equations.

1 + ☐ = 8

2 + ☐ = 8

3 + ☐ = 8

4 + ☐ = 8

5 + ☐ = 8

6 + ☐ = 8

7 + ☐ = 8

NOTE: Here are all the addition facts for 8.

Have the child draw two sets of things which, when joined, contain eight members.

He should realize that equations for 8 either name two sets which are joined, or show two subsets which together have 8 elements.

In both cases, it should be stressed that the numerals on one side of the equation rename the number on the other side of the equation.

COUNTING NUMBERS TO EIGHT

Write the missing numerals.

1	2		
	6	7	

Arrange the numerals below in the correct order for the set of counting numbers through eight.

6	8	5	3	7	1	2	4

Make each equation true.

1 + 1 = ☐
2 + 1 = ☐
3 + 1 = ☐
4 + 1 = ☐
5 + 1 = ☐
6 + 1 = ☐
7 + 1 = ☐

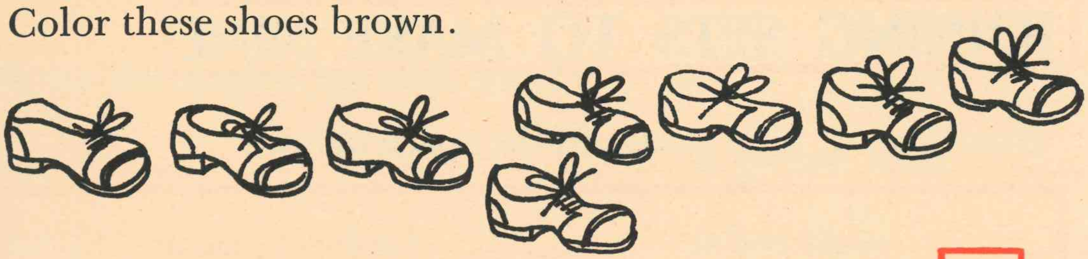
7 + 1 = ☐
6 + 1 = ☐
5 + 1 = ☐
4 + 1 = ☐
3 + 1 = ☐
2 + 1 = ☐
1 + 1 = ☐

NOTE: The child should know the order of the set of counting numbers from 1 through 8, and should be able to write the numerals.

He should also recognize the "one-more" pattern in counting numbers.

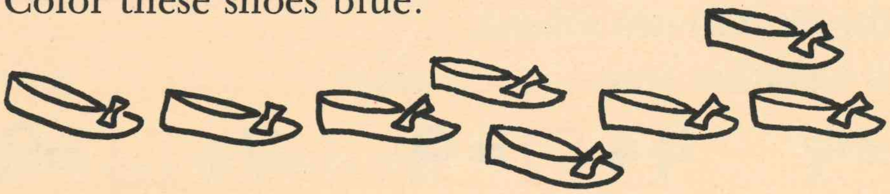
NINE

Color these shoes brown.



Write the numeral for the set of brown shoes. ☐

Color these shoes blue.



Write the numeral for the set of blue shoes. ☐

Draw one more blue shoe, next to the set of blue shoes above.

Now there are *nine* blue shoes.

The numeral for the set of blue shoes is written 9.

Practice writing the numeral 9.

9 9 9 ___ ___ ___ ___

The numeral 9 means 8 and 1 more
or 8 + 1.

NOTE: Have the child collect, or draw, other sets of nine elements.
Point out that the numeral 9 in type is slightly different from the handwritten 9.

EQUATIONS FOR NINE

RENAMING NINE

JOINING SETS TO MAKE NINE

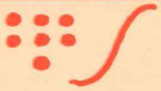
Draw a set of nine things in the space below.

Separate the set into two subsets.
Make each equation true.

1+☐=9
2+☐=9
3+☐=9
4+☐=9
5+☐=9
6+☐=9
7+☐=9
8+☐=9

In each equation above, 9 was renamed.

In each box below, draw another set so that the two sets together have nine members. Finish each equation.

1+☐=9	2+☐=9	3+☐=9	4+☐=9
5+☐=9	6+☐=9	 7+☐=9	8+☐=9

NOTE: On this page are all the addition facts for 9.

REVIEW

Write the symbol for each word.

one ______

three ______

five ______

seven ______

nine ______

two ______

four ______

six ______

eight ______

equals ______

is greater than ______

is less than ______

plus ______

Make each equation true.

7 + 2 = ☐ 6 + 2 = ☐ 3 + 3 = ☐

4 + 3 = ☐ 8 + 1 = ☐ 2 + 2 = ☐

3 + 2 = ☐ 2 + 4 = ☐ 4 + 4 = ☐

Finish the number sentences below by writing the correct sign of inequality.

3 < 5 8 6 9 6

9 8 4 3 2 3

7 4 7 5 8 3

Write the set of counting numbers from 1 through 9 below.

___ ___ ___ ___ ___ ___ ___ ___ ___

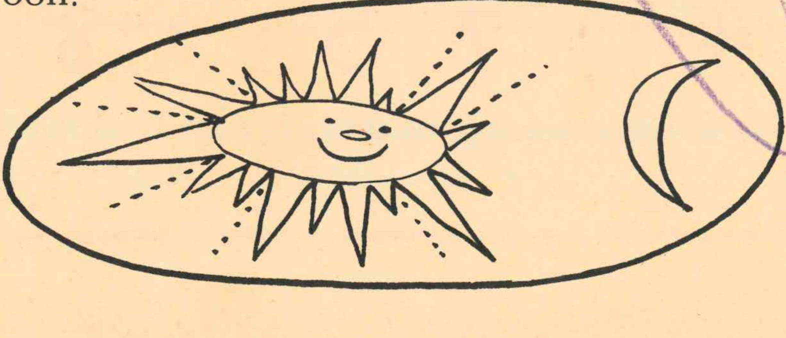
What can you do with the things you have learned in this book?

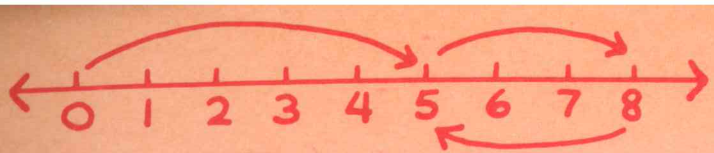
You can write the symbols for numbers as easily as you can write your own name.

You can tell if there are more children in your class than chairs, or more feet than rubbers. If you are the milk monitor, you will know how to match a carton of milk to everyone in the room.

You can rename a number with different names. You can add!

You can join sets of things that are alike – pennies or pop bottles or peanuts or people. You can join sets of things that are different – cats and mice or numerals that stand for different numbers. If you want to, you can even join the sun and the moon.





5+3=□
□−3=5

set partition

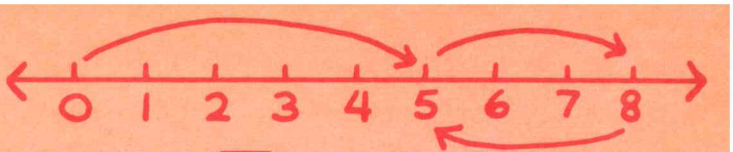
X ÷

+	0	1	2
0	0	1	2
1	1	2	3
2	2	3	4

2 X 5 = 10
5 X 2 = 10

expanded notation

41 = △ tens + □
+55 +▽ tens + ▽
◇ tens + ○ = ⬠



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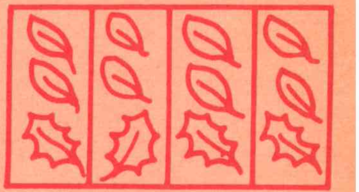

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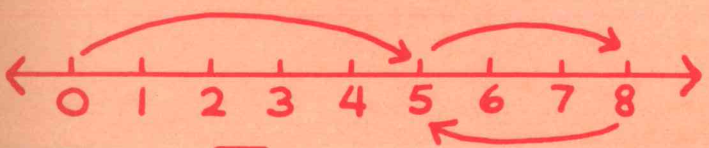

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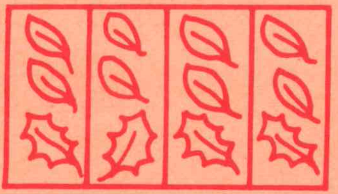

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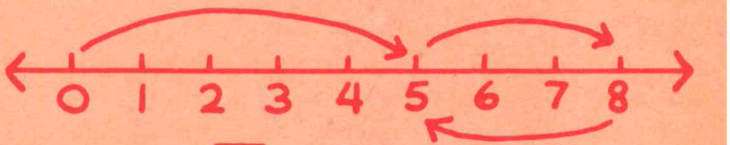
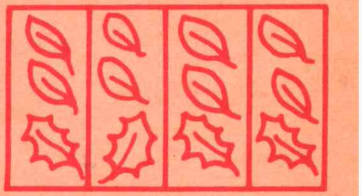


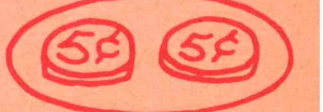
5+3=□
□−3=5

set partition



X ÷

+	0	1	2
0	0	1	2
1	1	2	3
2	2	3	4



2 X 5 = 10
5 X 2 = 10

expanded notation

41 = △ tens + □
+55 +▽ tens + ▽
◇ tens + ○ = ⬠

NEW MATHEMATICS

SETS AND ADDITION

The teaching of mathematics has recently undergone great changes. Simple arithmetic is now taught so that even at the elementary level, it can lead directly to algebra and logic.

This book will help children, parents, and teachers who want an introduction to New Mathematics or who need additional practice materials in set theory and addition facts from 1 to 9. Notes on each page further explain the concepts and terminology used for parents and teachers.

You will find answers to these and many other questions:

What is a set?
What is one-to-one matching?
Why can't you write a number?
How are sets joined?
What is an inequality?
What is an equation?
How are placeholders used?

Books in the series include:

2601	SETS AND ADDITION
2602	SETS AND SUBTRACTION
2603	UNDERSTANDING NUMBER COMBINATIONS
2604	DISCOVERING NUMBER CONCEPTS
2605	USING NUMBER PROBLEMS
2606	SETS AND MULTIPLICATION
2607	SETS AND DIVISION

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